Ontario Recreation Facilities Association

Building Community Since 1947

Arena Boards, Shielding and Protective Netting (BSPN) Systems

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Building Community Since 1947

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1.1 Introduction

Notice of CSA Guidelines for Spectator Safety in Indoor Arenas (CAN/CSA-Z262.7-04) - Withdrawn
November 4th, 2014
Re: Proposed Withdrawal of CAN/CSA-Z262.7-04 *Guidelines for spectator safety in indoor arenas*

This letter is to advise you that the Technical Committee on Equipment and Facilities for Ice Hockey (TC-S702) agreed that CAN/CSA-Z262.7-04 *Guidelines for spectator safety in indoor arenas* should be withdrawn. During the last CSA Group Spectator Safety Subcommittee meeting, participants identified that the proposed new edition, after editing, would result in a very small document. Members agreed that the far more detailed and widely used Ontario Recreation Facilities Association (ORFA) documents make the CSA document unnecessary and agreed to seek confirmation from the TC at their meeting on September 16. During the TC meeting it was reported that the document had originally been developed from an ORFA seed document to address pucks flying over glass and potentially injuring spectators but that it was intended only for new builds. Since then ORFA has developed a whole series of standards to address both new arenas and retrofits and has provided these to the Canadian Recreation Facilities Association (CRFC). In-light of these developments, the TC agreed that responsibility for spectator protection belongs with those building the sports facilities and would withdraw CAN/CSA-Z262.7-04. Please advise us of any concerns with this approach as soon as possible
Cathryn Cortissoz, Project Manager,
Health Care and Community Safety, CSA Group

In this document, the ORFA offers a (non-compulsory) template for new system design or retrofits. The information is presented with an attempt to standardize the games played in these environments. There was/is no specific legal requirement to be met when designing and installing a dasher board system. The CSA decision of withdrawing the non-mandatory Guidelines for Spectator Safety in Indoor Arenas (CAN/CSA-Z262.7-04) has resulted in the ORFA's Board, Shielding and Protective Netting (BSPN) guideline as being considered industry best practice. The ORFA has carefully considered the original CSA standard and will continue to use the information as a form of legal precedence, and will continue to reference CSA directives as part of this revised document. This document further combines several other ORFA Guidelines and Best Practice documents that may have been standalone resources. This document replaces all other previously released documents on the subject.

Although the ORFA may play a role in the provision of information on the topic, it is not considered an authority on dasher board design, installation and protective systems. The available options, hardware and professional installation methods are continually changing. This requires owners to be diligent in researching what system might best meet their immediate and long term needs. This document should not be considered a complete technical resource for tendering or design purposes. Measurements and design specifications are given as reference points only and should be verified through professional architects and engineers prior to adoption.

The two (2) primary goals of an ice arena BSPN system:

1. Designed to offer a safe and consistent sport play environment across North America; and;
2. Considered as part of a non-player protection barrier from objects that may leave the field of play.

1.2 Definitions

The following descriptions are considered common terms and technical verbiage associated with dasher board systems and referenced throughout the document.

Activity – a sport or recreational event, game or activity

Amphitheatre – essentially an outdoor theatre with attendees in fixed seats. They need to see, but they don't really need to hear

Arena – a facility with a flat floor; 5,000-20,000 tiered seats; oval shaped

Auditorium – a facility with a flat floor; oval shaped with horseshoe shaped seating focusing the line of site on the floor; usually much smaller than arenas

Boards – refers to the lower portion of the barrier. It can be made of steel or aluminum covered with wood, plastic or combination thereof

Built In Place (BIP) - refers to a permanent board and shielding system that is built on site

Community Arena – a building (under 5000 seats) constructed primarily for community sporting activities. Seating may be on one side, two sides, three sides or surrounding the surface. These facilities are not always constructed with the appropriate board, shielding and protective netting to host: league sports (OHL, NHL), game events (summer/winter games), family concerts, rock shows, religious assemblies, trade and consumer shows, circuses, sports and para-sports events and should be considered high risk if not revaluated if consideration for hosting such activities/events is undertaken.

Co-Owner – an organization or entity with specific contractual authority to use the facility to host a sporting or entertainment event.

Dasher boards – where the term "dasher board" is derived from is unclear. Some believe it relates to a screen that was placed on the front of a horse-drawn vehicle to intercept water, mud, or snow while another sets the origin as the Scandinavian word "dash" that means to strike, abash or come up against violently. In this guideline, it refers to both the hard barrier and the protective shielding as one unit.

Full Seamless Wall of Shielding – a barrier designed totally of tempered glass. Usually for figure skating and indoor soccer facilities.

Indoor Arena – an indoor facility where sport of recreational activities take place.

Non-Participant – a person present in an indoor arena but who is not involved in (see Participant) or watching (see Spectator) an activity e.g. arena employee, officials that either prior to or after taking part in an activity/event.

Operator – an individual, individuals, an organization, or an entity tasked with operating one or more arenas on behalf of the owner.

Owner – as defined in the Occupational Health and Safety Act "includes a trustee, receiver, mortgagee in possession, tenant, lessee, or occupant of any lands or premise used or to be used as a workplace and a person who acts for or on behalf of an owner as an agent or delegate".

Participant – a person taking part in an activity for which the indoor arena was designed and built e.g. a player or official.

Participation rink – a facility with limited seating for spectators.

Prefabricated Systems – refers to systems built off site and shipped to the facility for installation. These designs make up the majority of systems sold in the industry, whether in a retrofitted building or a new building.

Protective (safety netting) System – a system of netting of sufficient strength and durability to ensure adequate protection of spectators from objects (balls, pucks, sticks, or water bottle), which can leave the playing area.

Shielding – the barrier placed on top of the boards. It can be either glass or fence.

Stadium (25,000+ seats) – professional and college football stadiums are characterized by rectangular or oval seating configurations; most often used for significant ice hockey events (NHL Winter Classic).

Spectator – a person who watches an activity for which the indoor arena was designed and built.

Spectator Arena (5000 -25,000 seats) – is a building for structured, high caliber sports and other forms of entertainment. It has a large central area surrounded by seats. These venues are specifically designed to regularly host: league sports (OHL, NHL), game events (summer/winter games), family concerts, rock shows, religious assemblies, trade and consumer shows, circuses, sports and para-sports events, community programs (when the venue is available).

Test object – an object (simulation) used in the activity.

Theatre (up to 3,500 fixed seats) – permanent stage; with seating arranged on a sloped floor in front of and to the sides of the stage; a loft above the stage allows for quick scenery changes; may include acoustic shells or orchestra pits.

1.3 Chronology of BSPN Construction Materials and Methods

There has been a twenty-year cycle (estimate) in major construction of Canadian ice rinks. These cycles have consistently brought new technologies in board and shielding construction. Through these changes a recognized minimum construction design has naturally evolved as industry best practice that is often used in litigation to gauge a facilities ability to provide adequate protection to those who enter and use the facility. All information contained within should be considered a minimum level of design and construction.

Note: The life-cycle of a traditional ice rink BSPN system is estimated at 25-years.

Trying to keep the puck in play during early games had snow banks being created, bales of hay being piled and finally a fence styled design. The following provides a brief historical overview of ice arena board and shielding evolution.

1950's

- Dasher boards were constructed like wooden fences covered with plywood sheeting.

- Materials used were the off-the-shelf wood materials with basic hardware that was adapted to the boards.
- Systems were considered high maintenance requiring ongoing painting and repairs.
- Chain link fencing was introduced to keep the puck from going out of play.

1960's

- The plastic industry provides arenas with acrylic (Plexiglas) panels to replace chain link fences.
- Custom aluminum extrusions were experimented with to hold the acrylic panels in place.
- Shield height of 60cm (2ft) on the sides and 120cm- 150cm (4 to 5ft) on the ends was considered standard.
- 6mm (¼in.) polyethylene began to be used to cover the plywood, improving the playability of the boards and reducing maintenance.

1970's

- Government funding assisted with rink construction across Canada.
- Companies with experience in supplying rinks worked closely with communities to build what was considered a "complete system" – often referred to as the "Vallance" system after the designer Doug Vallance.
- Vallance systems are comprised of a post on 120cm (4ft) centers with three stringers (originally wood).
- A 50mm – 150mm (2in. x 6in) wooden board was secured on top and 19mm (¾in.) plywood was placed on front, covered with 6mm (¼in) polyethylene.
- Systems were built on the perimeter pad.
- Variations of this basic design were introduced with a wide variety of hardware, supports and anchoring systems were experimented with.
- Tempered glass was introduced as a more durable shield, and the design of shield supports continued.
- In the U.S., the Fiberglas system was introduced and formed a template for many rinks large and small across the country.
- Manufacturing became a more acceptable means of building dashers in the U.S., than in Canada.
- First pre-manufactured system was installed at the Winnipeg Arena.

1980's

- Various manufacturers were supplying Built In Place (BIP) systems in Canada, and a pre-manufactured variation of the BIP system or Fiberglas in the U.S.
- As a way to reduce weight, the first aluminum system was released in Western Canada.
- Advertising was introduced onto the face of the dashers in the NHL.
- The first seamless glass dasher system was designed by an engineering firm and installed at Sask Place in Saskatchewan. This was a revolutionary heavy framed prefabricated steel design. The glass was at the front of the system and held in place by two large steel angles, which sat on top of each other.

1990's

- Produced a boom in major sized arenas that had shield heights that were more specific to the size of the building.
- Large arenas begin to install 180cm (6ft) high on the sides and 240cm (8ft) high on the ends – community rinks 120cm-180cm (4ft and 6ft) respectively.
- Steel ice dams and flexible dasher developed due to injuries on seamless tempered glass systems
- Between the 1970's and the 1990's many advances continued to take place. 12.5mm (½in.) Polyethylene became a replacement for wood altogether due to its low maintenance and ease to work with (also because plastic companies were driving rink development).
- Steel/Aluminum replaced wood on the dasher system frames to extend the life of the system.

2000's

- ORFA releases first BSPN guideline (2001).
- Seamless glass is no longer being installed – experimenting with different designs that provide more flex while bringing back the noise excitement of the game begins.
- Concern over board top sill lip dangers begins to emerge – soft cap introduced.
- Vertical lift gates gain popularity.
- Brittanie Nichole Cecil dies from injuries suffered when a puck was deflected into the stands at Nationwide Arena in Columbus, Ohio (2002).
- NHL brings in protective netting installation policy (2003).
- HC introduces long term player development program that results in the creation of cross ice training that sees the introduction of a portable board system to divide the ice into sections.
- The Accessibility for Ontarians with Disabilities Act, 2005 to benefit all Ontarians by developing, implementing and enforcing accessibility standards in-order to achieve accessibility for Ontarians with disabilities with respect to goods, services, facilities, accommodation, employment, buildings, structures and premises on or before January 1, 2025 was introduced.
- ORFA plays key role in developing HC/CRFC Sledge Hockey Accessibility design guidelines for arenas (2007).
- NHL begins to experiment with larger shielding to improve sightlines and speed conversions by removing stanchions.
- ORFA updates the Guidelines for Evaluating Arena Dasher Board and Shielding Systems document (2009).
- Glass tear away film protection is introduced to quickly remove puck marks on shielding in high caliber hockey arenas.
- Significant stanchion injury in the NHL results in curved protection for end player box stanchions to be created for professional facilities that are out of reach financially for most community arenas causing them to review stanchion padding and ongoing inspection of these devices (2010).
- ORFA creates and release a facility advisory on the topic (2011).
- ORFA release guideline on ice arena safety netting (2013).
- Tempered glass that does not explode when broken is introduced.

- CSA Withdraws their Guidelines for Spectator Safety in Indoor Arenas (CAN/CSA-Z262.7-04) (2014).
- ORFA releases updated BSPN Guideline (2015).

Note: Arenas that may be considering a change in shielding height must bear in mind that an increased height may impact air flow in the bowl area resulting in poor air quality.

1.4 Specialty Board Systems

Arenas continue to respond to the needs of their users. Events such as figure skating are more focused on visibility rather than game control. In such venues, a full seamless wall of shielding has been used while some operations merely needing to create a boundary that identifies where the surface ends and dry floor begins. There is a growing marketplace for systems that control dry floor sports.

Sledge hockey follows International Ice Hockey Federation (IIHF) rules with a few modifications and as such can be played on any existing hockey surface. Current dasher board design specific to height and construction are considered acceptable, New construction must consider design to meet the needs of persons with accessibility needs.

For access to the complete Guide to Sledge Hockey facility design – please download the following file: http://orfa.com/resources/documents/librarydocs/guides_bp/Sledge_arena_guidelines.pdf

1.5 Protective Barriers Above the Dasher Board

Protection above the dasher board was originally placed to keep the game in play – spectator safety was a sidebar to the installation. This has since shifted to spectator safety being the priority and game momentum being second. Designing a system to meet these objectives in every facility presents different challenges. Slope of seating and sightlines will require careful consideration to ensure that gaps or other opportunities for projectiles to escape do not exist.

There are three (3) main protective above board barriers used in ice arenas:

1. Chain link fence
2. Acrylic
3. Tempered Glass
   *Some facilities have placed a complete dasher board plastic wall on rink ends that do not have any access ability in lieu of acrylic or glass.

Chain link fence is primarily used in outdoor construction. It is inexpensive and very durable. It is recommended if chosen that coated chain link fencing be used.

Acrylic shields are light and easily handled. Often selected by facilities with quick changeover schedules. They are easily replaced when broken as acrylic can be cut safely with common tools. Careful review of the manufacturers cleaning directions must be observed. Acrylic has a shorter life cycle then tempered glass. An “abrasive resistant” acrylic shield is available.

Tempered glass is heavy and is not easily handled, however, it is simple to maintain and will not scratch easily. Tempered glass comes in standard sizes which are even measurements of 4ft x 4ft or 4ft x 6ft. Tempered glass that must be cut to fit increases operational costs. Facility management should develop an inventory plan that identifies each shielding size.

Holding one (1) of each glass size in stock is recommended. Careful review of the manufacturers cleaning directions must be observed. Broken tempered glass will leave millions of small pieces to be removed. Facilities will use acrylic to replace broken tempered shielding for short periods.

Laminated tempered glass is now available in the marketplace. It is designed to hold together when broken.

SAMPLE Weights of Shields:
Tempered Glass
6.5lbs per square foot @ 1/2-inch thick
(34.22kg per square metre @ 12mm thick)
8.5lbs per square foot @ 5/8-inch thick
(41.57kg. per square metre @ 15 mm thick)
Acrylic Sheeting
3.25lbs per square foot @ 1/2-inch thick
(14.67kg per square metre @125mm thick)
4.25lbs per square foot @ 5/8-inch thick
(19.56kg per square metre @15mm thick)

1.6 Safely Replacing Broken Shielding

Should a piece of shielding break during play facility staff will need to be able to effectively respond. As indicated, tempered glass will often explode into millions of small pieces. These pieces will fall onto the ice and into public seating areas. A quality industrial styled vacuum must be on hand to help clean up the pieces. Acrylic is less of a challenge to replace as the large pieces can often be quickly removed and disposed of.

Facility staff frequently “work-alone” when a piece of shielding brakes. It is recommended that facility management provide clear guidance and specific training on how the worker is to respond under such conditions. Shielding replacement is at minimum a two (2) person task with larger pieces of shielding requiring more human and equipment resources. Using volunteers in the facility to assist with a shielding replacement should be discouraged.

Not one procedure will work in every facility; each SOP must be created to be site specific. The ORFA Resource Centre does house some quality examples of well written procedures and as a benefit of membership, will share this information with members when so requested. The following sample provides some basic, generic steps to give an indication of how the task should be completed.

Caution must always be used to protect the edges of the tempered glass shielding when handling, as this is the weakest point of the shield. It should always be set down on a sheet of

plastic, or wood or cloth to ensure nothing on the floor causes the shield to break. This should be available for unloading or moving a tempered shield. Unlike acrylic, it cannot be dragged along a surface. When replacing shielding, especially tempered, it is also important to check the alignment of the shield support system to ensure everything is secure and properly aligned.

SAMPLE Shielding Replacement Guidelines

Facility staff advise that a piece of shielding has been broken.

1) Attend location and assess for injuries
2) Refer to master shielding plan
3) Remove patrons from the area
4) Secure area
5) Review facility SOP for this task
6) Retrieve and wear appropriate PPE
    a. Head protection
    b. Foot protection
    c. Eye protection
    d. Hand protection

7) If tempered glass
    a. Sweep up areas on and off the ice – push broom, corn broom, shovel, large garbage can
    b. Vacuum patron side of area as well as all channels in dasher board
    c. Remove, inspect and clean all installation hardware
    d. Drop in a piece of plywood or acrylic
    e. Resurface ice – thoroughly clean ice resurfacer when complete
    f. Consider how to deal with ice shavings containing shards of glass
    g. Clean tools
    h. Dispose of broken glass
    i. Complete incident report

Facilities that conduct conversions should invest in proper glass handling suction clamps and proper glass storage carts.

8) If acrylic glass:
    a. Attend location and assess for injuries
    b. Remove broken pieces
    c. Refer to master shielding plan
    d. Remove, inspect and clean all installation hardware
    e. Replace with new acrylic or plywood
    f. Dispose of broken shielding
    g. Complete incident report
9) Schedule a complete shielding replacement if so required.

    Note: a typical 6 x 4ft piece of tempered shielding will require 4-6 persons and take 1.5 to 2-hours to safely complete.

10) Workers risk
    a. Broken glass – eyes, cuts
    b. Lifting new glass or garbage can full of broken glass
    c. Shielding falling over on worker
    d. Improper storage of spare glass

11) When creating an SOP for this task, the facility should review and determine the best or safest way to replace or remove the shield supports. Supports should be a two-part support that can be removed from the ice surface.

Being prepared by developing and practicing a SOP for shielding replacement is the first step toward worker safety. Often a shielding will break during a significant facility event resulting is an unprepared staff member trying to effectively respond in the quickest possible way. Such a response places workers at risk of injury and as such should be avoided.

1.7 Shielding Supports (Stanchions)

Shielding Supports (Stanchions) are the sections that project upward from the dasher boards that hold the shielding in place. Common shielding support systems include:

- Aluminum 2-piece tube support
- 2-piece aluminum quick release support
- Aluminum 2-piece support with pressure plate and neoprene gaskets.
- One piece aluminum support
- Clear polycarbonate supports
- Channel in dasher board and polycarbonate clips
- Channel in dasher board and polycarbonate sleeve (seamless acrylic)

Shielding supports are installed on the ice side and should be no less than 2.133 m (7ft) from the top of the ice. Most common installations have a 37.5 mm (1.5in.) thickness at the top of the support. The support is generally mounted on the middle stringer in a cup or bracket. All aluminum shield supports require a gasket to protect the shielding from breakage along the edges. A gasket/shock absorber installed between the shield and the dasher board have also been used.

Two-piece aluminum supports – are most common in community rinks. It is approximately 50mm (2in.) wide and includes a flat or slightly beveled ice-side face plate to reduce puck bounce. They are mechanically fastened to the body of the support and can be removed to replace the shield from the ice side.

Quick release support – is a two-piece aluminum support with no mechanical fasteners is also removed from the ice side. The faceplate is flat to reduce puck bounce. Often used in high conversion facilities to assist with quick changeovers.

One-piece solid aluminum shield support – is a typical H design that is used in lightweight inline applications. Similar one-piece supports are used for gate terminations or any point where the shielding ends. This one-piece design can create a worker glass removal risk and hazard challenges.

Clear polycarbonate supports – are designed as a one-piece alternative to the seamless system. It provides a relatively clear view and significant flex. This design is also known to create some glass removal issues.

Seamless Glass Systems – use no shielding supports. Tempered glass must be used because of its ability to remain rigid without a vertical support. The support mechanism for the shields is a combination of a top clip, a bottom clip and the shield groove. The top clip is generally

manufactured from Lexan and prevents the shields from separating. The shields are also supported at the bottom in a groove that is at least.75mm (3in) - 100mm (4in) deep. This channel is the key to providing movement. To ensure no contact between shields occur, bottom clips are required. Contact could instantly shatter the glass.

1.8 Termination Points

The stanchions that are at the end of the shielding at each player box area, and, at times installed as part of the penalty box areas are referred to as "termination posts". These areas can place users at risk if extreme contact occurs. The ORFA supports the ASTM document F1703-04 that addresses the protection on the end of the glass. The following is posted under section 4.7.5 "*Enclosure support posts that form a corner and are exposed to the playing area (player and penalty benches) should be padded to a minimum thickness of 50mm (2in) with a closed-cell shock absorbent material. The material should be covered with a non-cellular flexible cover to protect against abrasion of the absorbent material".* The NHL uses a curved shielding system that is often financially out of reach of community rinks. It is important that regular inspection of the termination point areas and protective equipment occurs.

1.9 Dasher Board Anchoring System Designs

The dasher board system must be securely anchored in place. The system must have some flexibility and as such should not be mounted directly to an exterior wall or seating area. Ice resurfacer operators must not contact the dasher boards while resurfacing. Dasher board systems can fail from constant pressure being applied by riding the boards with the ice resurfacer.

Permanent Anchors – are welded or fixed in place under the center posts of a built-in-place dasher system. These anchors are installed prior to the posts being set in place and are located on the perimeter slab. Generally, a curb accompanies this type of construction to allow the posts to fit close to the edge.

Cast-in-Place Anchors – are used when the dashers are to go directly on to the refrigerated floor. These anchors are generally made up of a 15mm (5/8in.) thread-coupling bolt attached to a threaded rod and welded onto a bottom plate. The design allows the anchor to be laid out on the insulation and between the pipes prior to the concrete being poured. The anchor layout must be drawn in advance and should be coordinated with the refrigeration and seating contractors to ensure correct placement of the anchors. The threaded rod allows the adjustment of the anchors prior to the pour. Levelling of the anchors is best done with a laser levelling device.

Wedge Anchors – when placing the dashers on the perimeter pad a drill in concrete anchors are used either with epoxy or without. The anchor is a minimum 76mm (3in.) long with a minimum 15mm (5/8in.) thread. Epoxy provides a stronger set in the concrete and is recommended. The anchor layout can be done at the time of the dasher installation, but be laid out in advance by the systems manufacturer.

Dasher Board Curb Detail

Dasher board systems are constructed on or surrounding a refrigerated slab. Systems can be anchored directly to the slab; or anchored to a synthetic ice dam that is placed on the concrete slab as a barrier that helps expedites changeovers or; it can sit on a 50mm – 150mm

(2in.-6in.) permanent concrete curb or an apron slab which surrounds the refrigerated floor system. Which design detail is best to be used is determined by the proposed uses of the facility. In community rinks, used for mostly ice events and the occasional non-ice event, the boards are typically permanently installed onto an apron curb or on the flat refrigerated slab. In multi-use facilities, where a variety of events are held and the dasher boards are removed on a regular basis, dasher boards are typically installed onto a flat floor.

In multi-use buildings that require the removal of the dasher boards to allow for a larger unobstructed floor space the anchoring detail must allow for a flat floor when the boards are removed. In this situation, the apron slab and the refrigerated slab are finished to the same elevation. When the boards are removed, the floor provides a risk reduced surface free of obstacles and trip hazards. In this situation, the dasher boards could be installed on either the refrigerated slab or the apron slab.

In community arenas where the removal of the dasher system is not required, the dasher boards are typically installed onto a curb on the apron slab. This curb is usually 50mm-150mm (2 – 6in.) higher than the refrigerated slab. The higher the curb, the bigger the step down onto the rink slab. Most new arenas are designed with a 50mm (2in.) high curb. This curb allows the dasher system to be installed above the ice surface helping to prevent water leakage under the boards and containing the ice inside a concrete "pool" on the refrigerated slab. This design helps to reduce the wear and tear on the dasher frame components and helps keep the ice from creeping under the boards. Occasionally, a curb detail is designed into the refrigerated slab and the dashers are installed onto a curb that is a continuous part of the refrigerated floor. This design allows the dashers to be installed onto the refrigerated slab while also raising the boards above the ice surface. This design is not common.

Ice Dams – are an integral part of the multi-purpose facility dasher system. Ice dams provide a solid edge to contain the ice when the dasher boards or lift-out sections are removed for an event. Ice dams are typically 25mm (1in.) or 50mm (2in.) thick and 150 mm (6in.) to 175mm (7in.) wide. Whether they are partial ice dams at lift-out sections or a complete rink perimeter ice dams is determined by facility use and the conversion process. The ice dam is bolted to the perimeter of the ice rink and the dasher boards are installed on top of the ice dam. It is recommended that the ice dam be independently anchored and not reliant on the dasher anchors to hold it in place, A 50mm (2in.) ice dam will not only hold the ice in place when the boards are removed it will also act as containment for an ice floor cover. Ice dams are most commonly manufactured out of stress relieved High Density Polyethylene (HDPE) or galvanized, powder-coated or zinc-plated steel channel. Another important role of the ice dam is to retain the ice floor cover. A properly designed ice dam or sections of ice dam will help speed the conversion process and maintain the integrity of the ice. In some facilities, an ice dam is being placed even if the dasher board is being designed not to be regularly removed.

Note: It is strongly recommended that the dasher board system be designed so that the ice resurfacer can enter and leave the surface with no ramp requirement.

1.10 Dasher Board Frame and Cladding System Designs

Players look for what is referred to as a "true bounce" meaning that the puck is not slowed or caused to react in an unnatural manner against the dasher system, while spectators enjoy, the noise created by the board and glass system as part of the experience. Dasher board height is

measured with no ice. Community rink board height can vary between 101.8cm – 121.9cm (40-48in) 106.7cm (42in.) being most commonly used. Adult players may not have an issue with 121.9cm (48in.) board height while younger players may struggle with the height. Design is determined by materials being used. Non-corrosive materials should be selected. To reduce maintenance, 12mm (½in) Polyethylene is mounted directly to the frame. This material is often referred to as "puck board". The material is designed to expand and contract without damage. It must remain smooth and clean with no damage. Mounting screws must always be flush. Cleaning and maintenance of the cladding must be scheduled. This can be accomplished by hand or machine scrubbing followed by an application of fresh sealer/polish. Review the manufacturer upkeep recommendations. A daily inspection of the system with repairs or maintenance being logged is an important part of every facilities risk management plan.

Options for the surface of a dasher frame include:

- Plywood with 6mm (1/4in.) polyethylene
- 12.5mm (1/2in.) Polyethylene
- 12.5mm (1/2in.) Ultra high molecular weight polyethylene (UHMW)
- Fiberglass/Urethane – normally used for outdoor sports

Note: When purchasing Polyethylene it is recommended that a "virgin grade HDPE" product be requested as it is a more durable better appearing product when compared to economical materials that contain "regrind" substances. Regrind products require more cleaning effort to maintain and are prone to breaking.

1.11 Dasher Board Sills, Sill Bands and Kick Plate

The top of the dasher board system will have a sill plate (usually a 50mm (2in.) x 150mm (6in) high-density 12.5mm (1/2in.), 19mm (3/4in.) or 25mm (1in.)) polyethylene material. The edge of the top sill must have a radius that reduces the potential for player injury. The thicker 25mm (1in.) top sill has minimal expansion or contraction and tends not to wear out at the support holes as quickly as 12.5mm (1/2in.) sill. The sill band, which lies directly below the sill plate facing the ice surface, is usually 50mm (2in) wide and placed to cover the joint between the top sill and the dasher facing to help reduce injury caused by gaps through the contraction and expansion of the plastic.

The kick plate is installed at the bottom of the cladding. Kick plates are most often 200mm (8in.) high with a thickness of 12mm (1/2in.). In sand floors the kick plate is often extended down an additional 50mm (2in.) to 75mm (3in.) to provide or hold in a moisture barrier. Although there are no legal requirements for kick plate colours Hockey Canada recommends that the kick plate be yellow or gold. Facilities that offer ringette should avoid the colour blue as it is the same colour as the ring used in this sport. To avoid corrosion, it is recommended that stainless steel fasteners for the bottom row of screws be used.

Note: a properly constructed and maintained board and glass system will assist in keeping the bowl area cold thus reducing refrigeration load demand.

1.12 Players, Penalty, Timekeeper and Camera Boxes

These areas are an integral part of the playing area and dasher board system. Most common layouts have the player's boxes on one side of the surface and penalty boxes being separated by the timekeeper's box on the opposite side. A standard length of a player box is 11.8m (30ft).

Depth is no less than 1525mm (5ft) maximum depth of 2440mm (8ft). Floors of the boxes should be designed with a permanent resilient rubber flooring. The floors can be raised behind 150mm (6in) to 200mm (8in.). Raised floors allow for simple removal for changeovers and provide easy access to the ice from the boards. Benches are typically 228mm (9in.) wide and a height of at least 609mm (24in.) above the flooring. The benches are mounted to the concrete floor or inserted into bench bracket supplied by the manufacturer. It is strongly recommended to include floor drains in the concrete floor of the players and penalty box bench areas. Player boxes must have one (1) door on each end for players to get on and off the ice. If a coaching catwalk is to be installed the height should not exceed 7.5 inches.

Penalty boxes are typically 2.4m (8ft) long placed on either side of the 1.8m (6ft) long timekeeper's box. There should be a table in the scorekeeper's area and access to penalty boxes for closing the gates after the players leave. All players' boxes and penalty boxes shall have protective glass of the same height as the adjoining board glass along the ends and back of the box to protect spectators in walkways, alleys and seating area. In front of the home and visitor penalty boxes the glass shall be continuous and be the same height as the adjoining protective glass. For consistency and fairness of play, glass installation and height should reflect the installation at the opposite end.

The box areas need to be reviewed and laid out properly for functionality and access points prior to construction. It is recommended that access to the timekeeper's box should be available without the need to step onto the ice. The penalty box's must be closed off from ice side access accept via the scorekeeper box for protection of players and officials.

Camera boxes are most often installed between the player's boxes and on both ends of the penalty boxes. They should be the same depth of as the player or penalty box and wide enough to comfortably hold the individual and their equipment. The area should be designed to provide full protection. The shielding is often cut to allow a camera to shoot directly onto the ice and not through the glass. When not in use these holes must be filled. These areas are also utilized as VIP Box when not being used as a broadcast booth as another source of facility revenue.

1.13 Dasher Board Gates and Hardware

Proper gate anchoring is critical to gate performance. Anchoring failure is often the root cause of poor gate function. Facility operational staff must perform regular inspection and maintenance to ensure all gates remain safe and serviceable. This should include annual anchor inspection. In new construction, the gate location should be reviewed with local fire officials to ensure compliance with up to date fire egress regulations.

Gate Hardware – it is important when considering dasher systems that hardware meets facility user needs and are of sound design. The marketplace continues to offer improved materials and designs. Reaching out to ORFA members for up to date information on gate and hardware and installation methods will assist in the selection process.

Common Hardware Materials

- Galvanized steel
- Stainless steel
- Zinc plated

- Nylon bearings built into a hinge is an advantage.

Types of Door Hinges

- Piano hinge
- Pin hinges, minimum of 2 per gate, available with self-lubricating features and easy lift off
- Heavy-duty adjustable hinge, used for large gates that can be adjusted vertically and horizontally to properly, align the gate. (Machine or equipment gates should have a minimum of two (2) hinges per door).

Latches – most are gravity that are simply pushed down or lifted up. This reduces the amount of moving parts and ensures the latch will be down to fit into the strike plate attached to the dasher frame. Latches should be easy to operate with a hockey glove or by a small child.

Goal Judge Boxes – minimum size is 121.9cm (48in.) x 121.9cm (48in.) with an entry side gate.

Storage – dasher board systems that are removable require shield carts. The dasher carts are a simple flat bed with removable posts that are stackable. Generally, 9 carts are required to store an entire dasher system. Glass storage frame carts are used to move and safely store shields. A forklift, complete with glass lifting attachment is considered standard equipment.

Cross Ice Dividers – are used to maximize the surface by dividing the area. Facilities must be designed to store these systems when not in use.

Backer Panels – backer panels are used to close in the back of the dashers. The installation of backer panels is primarily aesthetic however, they will help reduce moisture migration to the surface while controlling waste from collecting.

Insulation – to help control heat transfer insulation can be added to reduce the migration to the ice surface. Insulation should be considered in areas in close proximity of warm areas such as lobbies or heated seating. Insulation must be moisture and mould resistant.

Electrical Needs – must be considered as part of the overall design. As the dasher board systems is prone to coming in contact with water GFCI electrical is required. Consider the outlet needs for special events that might occur in the facility.

Vertical Lift or Machine Gates – are considered an efficient alternative for the machine gate because push-button control can be operated by one operator. Most gates are self-levelling with adjustable hardware for ease of operation and maintenance. Machine gates require a steel threshold. Thresholds on access gates need to be covered with 50mm (1in.) poly and will vary in height Vertical lift gates are available in an electric, hydraulic lift or the original chain hoist. They must be designed and installed with safety features in case of cable, chain or hydraulic failure. Inspections must be completed at minimum, annually by a qualified professional.

The following chart details types and sizes of gates found in ice arenas. Sizes may vary with each facility depending on the age of the system and access to the rink.

Types of Gates	Gate Sizes	Hinge Type
Double swing machine gate	120" (3048mm) in width	HD adjustable
Overhead lift machine gate	120" (3048mm) in width and height	
Player/Penalty box gate	30 "(762 mm) in width	Piano Hinge/ Pin Hinge
General access gate with 4" (100mm) to 8" (200mm) threshold	36" (914mm) in width	Pin Hinge or Standard hinge
General access gate c/w 4" (100mm) or less threshold	48" (1220mm) in width	As above
Double swing access gate	72" (1828mm) in width	Pin hinge or adjustable hinge
Lift-out /Concert gate	48" (1220mm) in width	Polyethylene slide track

All gates should swing outwards from the ice surface

- All gates which contain shielding must have an ice side door release mechanism that allows players to easily exit the ice area by opening the gate with hockey gloves.
- Gates must be properly aligned and balanced to function properly and should be regularly inspected
- Lubrications of all moving parts on gates is critical – recommended to use a dry silicone spray.
- A gate stop located at the lower part of the gate to prevent it from being pushed out too far and stressing the gate latch should be installed. It is important to keep the gate stop tightened to maintain proper movement of the gate.
- The ORFA recommends that all dasher board gates be labeled gate/exit

Dr. William A. Buckton, Coroner – Tim Hickman Accident (1996) Verdict of the Coroner's Jury (5). At Silverwoods arena not all gates from the ice surface were marked as such, and during the ensuing explosion and fire everyone on the ice attempted to get off through one gate.

1.14 Outdoor Dasher Board Systems

Outdoor board and protection systems are installed under the same rational as indoors. However, the operational and maintenance issues are increased based on exposure and vandalism. Expansion, contraction, decay and rust are common issues that must be monitored and maintained. Outdoor systems may require specialized materials and fastening hardware and methods. Owners are encouraged to discuss outdoor board and glass design with reputable suppliers of these products and service.

1.15 Minimum Protection Requirements

Owners are reminded that the arena serves as two separate environments – work and play. There is no expectation to place protection in any area that has no opportunity for an object to leave the playing surface and have contact with a human occupant i.e. a facility that has a dasher board system directly against an outside wall. However, the need to protect areas where non-participants or spectators may exist is an important element to the overall safety of those who visit or work in these areas. Non-play areas such as concession stands and open public zones require a heightened responsibility for review. Dasher board door openings that are left open must not align with facility access doors. Objects that leave the surface must not be able to exit into what should be considered non-user safe zones. Owners, through their evaluation findings must consider a balance of permanent or additional, temporary dasher board, protective shielding and netting to surround each playing area specific to the type of event that is to take place.

ORFA note: It should not be expected that one "protection system" can adequately protect every activity. To be successful an ongoing evaluation of activities must take place

ORFA Recommended Board and Shielding Construction Methods

The Ontario Recreation Facilities Association recommends that effective January 1st, 2016 that all new or retrofitted community ice arenas shall be constructed with the following measurements:

1. The ice surface shall be – 25.9m (85ft) wide – 61m (200ft) long
2. Corner radius shall be – 8.5m (28ft)
3. The full and complete ice arena board height for new or retrofitted community ice arenas shall be not less than - 106.7cm (42inches) and not greater than 111.76mm (44inches) when measured from an arena floor to the top of the board sill
4. The lip leaving the ice surface by the ice resurfacer gate shall not exceed 5.08cm (2in)
5. The step from the arena floor into the player box area or off of the ice surface shall not exceed – 228.6mm (9inches)
6. Shielding – from the neutral side of the blue lines to behind the net – 182.9cm (72in.) – in the neutral ice area – 121.9cm (48in) - the only area that there shall be no shielding is in front of the player boxes
7. Total recommended height of the neutral side of the blue lines to behind the net is 289.6cm (114in.) – 294.64cm (116inches)
8. Total recommended height in the neutral zone is 228.6cm (90in.) – 233.68cm (92inches)
9. The shielding system shall be designed to include as minimal special size shielding as possible approximately 10-12 pieces (max.)

Note: facilities undertaking upgrades to original board and glass design must be aware that increase shielding heights may disrupt air flow creating the potential for increased toxic air quality. Board and glass upgrades must include a ventilation impact study.

1.16 Protective (Safety Netting) Systems

Introduction

There is no regulatory obligation to install protective netting. In ice arenas. The decision to install protection is often based on the Occupiers Liability Act. The ORFA continues to

recommend that CSA Guidelines for Spectator Safety in Indoor Arenas (CAN/CSA-Z262.7-04) Protective (safety netting) System document which stated, *"that a system of netting of sufficient strength and durability to ensure adequate protection of spectators from objects (balls, pucks, sticks, or water bottle), which can leave the playing area should be installed in all arenas"*.

Most ice arenas have spectator netting installed. In many arenas, the netting system is permanent and is not easily removed or retracted. With increased demand for alternative use of the ice arenas operators should make certain that the netting system is properly designed and installed for their facility. In many mid-size and large arena's, the netting system is designed to be retracted or removed by using a manual or motorized winch and pulley system. In smaller arena's the netting can be pulled up by ropes or cables or manually removed for event purposes. The options available to operators range from simple to high-tech remote controlled truss systems.

There is a tendency to use NHL operations as a benchmark for community rink operations; however, using such a template is neither mandatory nor, recommended. The ice rink industry is better served by identifying specific best practices that are reasonable for a community rink environment. By having guidelines that best represent the level of play at a community level, the courts will more likely lean toward these recommendations when trying to determine "due diligence". It is however important to include some of the lessons learned at the professional level to develop appropriate best practices.

- The death of 13-year-old Brittanie Cecil in March, 2002 at a Columbus, Blue Jacket National Hockey League game was not an isolated event.
- March 1997: A 13-year-old boy suffered loss of academic, social and emotional functioning after a flying puck at a Windsor, Ontario rink put him into a coma.
- December 1998: The mother of a teenaged player lost her sight in one eye after a puck hit her while she was watching her son play in a Manitoba arena.
- January 1999: A nine-year-old Regina girl suffered a fractured skull and other injuries when a puck struck her above the right eye.
- February 2000: A 21-year old man fell into a coma and died five days after a puck hit his head at an Altona, Manitoba hockey arena.
- January 2002: A 53-year-old man took a puck in the left eye at a game in Sault Ste Marie, and was left with diminished vision.
- There is no specific data collected about puck injuries however, Toronto Maple Leafs hockey club stated that 11 of its spectators needed medical attention due to injuries from flying pucks in the 2001-2002 season up to March 22 - one fan for every three games before netting was installed.

The Brittanie Cecil accident was a turning point for many Canadian rink operators who began to voluntarily install safety netting as part of their efforts to help protect spectators from objects that may leave the ice surface. However, these early installations were completed with little or no guidelines in place.

The Canada Safety Council is on record of having a longstanding concern over the injuries occurring to non-participants in ice arenas. This concern prompted action that resulted in the creation of CAN/CSA-Z262.7-04, Guidelines for Spectator Safety in Indoor Arenas. This document provides guidance on safety to owners and operators, architects, planners, engineers, construction companies, construction contractors and appropriate inspectors in the design, construction, and operation of indoor arenas.

- Arenas should be designed to minimize the inadvertent or accidental interaction between participants, spectators, and non-participants.
- Arenas should be designed to reduce the risk of injury to participants if any object accidentally leaves the playing area.
- Design considerations should include, but not be limited to, concession stand location and arena illumination.

Owners are reminded that protective netting has a life-cycle and must be replaced. A further reminder of the obligation to ensure that the netting remains serviceable through a regular, detailed inspection and possible retesting program.

Occupier's Duty

3.(1) An occupier of premises owes a duty to take such care as in all the circumstances of the case is reasonable to see that persons entering on the premises, and the property brought on the premises by those persons are reasonably safe while on the premises.

Idem

(2) The duty of care provided for in subsection (1) applies whether the danger is caused by the condition of the premises or by an activity carried on the premises.

The CSA standard was voluntary and not retroactive. One of the key recommendations was that a board and glass system that permanently surrounds each playing area, with a minimum height of 2.4 m at the sides and 3.05 m at the ends of the playing area when measured from the playing surface. Some industry experts warn that these recommendations for shielding heights are at times difficult to meet. As the height and weight of the glass increases, so does the potential for worker injury. Consider the risks involved when 3.05m of glass breaks free and falls into the spectator area?

Additional protection systems may consist of a moveable board and glass system or a moveable safety netting system. However, these types of products are not considered standard installations within the industry. Custom needs should be identified and carefully investigated prior to purchasing. The standard also outlined measures to consider when an object can travel in a direct line from the playing surface to the spectators' and non-participants' areas.

The CSA document provided the following guidance that remains as an ORFA recommendation:

When the additional protection is tested in accordance with, there shall be no evidence of failure. The following shall be considered evidence of failure:

a) The test object penetrates the protection system;

b) The test object gets stuck in the protection system; or

c) A portion of the protective system, or components used to attach the protective system to the support frame, breaks or shows signs of damage (such as fraying or tearing).

The requirements of the Ontario Fire Code have prompted some municipal fire officials to question facility management on current arena safety netting installations and their obligation to meet a higher fire retardant requirement. Some facility managers do not have nor, have they been able to source confirmation in this regard. All safety netting must meet section 2.3.2.1(1) of the Fire Code.

Flame Resistance of Textiles
2.3.2.1.(1) Drapes, curtains, netting, and other similar or decorative materials, including textiles and films used in buildings, shall meet the requirements of CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films, when these materials are used in any

(a) care and treatment occupancy and detention occupancy,

(b) lobby or exit,

(c) access to exit in assembly occupancies, and assembly occupancies with an occupant load of more than 100 persons, or

(d) open floor area in a business and personal services occupancy, mercantile occupancy or industrial occupancy exceeding 1500 m^2, except when the floor area is divided into fire compartments not exceeding 1500 m^2 in area and separated from the remainder of the floor area by a fire separation having a 1 h fire-resistance rating.

(2) Existing drapes, curtains, netting, and other similar or decorative materials, including textiles and films used in buildings which meet the requirements for a high degree of flame resistance as described in NOTE 4 of Test Method 27.1 of CAN2-4.2, "Textile Test Methods are deemed to be in compliance with Sentence (1).

(3) For the purposes of Sentence (2), "existing" means in place on November 21, 2007.

Flame-proofing Treatments
2.9.2.1. Flame-proofing treatments shall be renewed as often as necessary to ensure that the material will pass the match flame test in NFPA 705, "Recommended Practice for a Field Flame Test for Textiles and Films".

NFPA	705-2003	Recommended Practice for a Field Flame Test for Textiles and Films	2.3.2.2. 2.9.2.1.

Housekeeping and Maintaining Your Netting System

Facility managers must not install and forget about their protective netting. Allowing dirt and dust to accumulate on the netting system will reduce the fire retardant level of the net. Grease residual resulting from Improper venting of concession operations will further increase the potential for fire on the system.

A regular cycle of inspection, cleaning and repair must be designed and implemented as part of any net protection system installation.

- Tightness/tension of the netting and installation
- Wear, holes, tears any signs of deterioration
- Check mesh hole size for any signs of excessive stretching
- Ensure tightness of all fittings and stability of installation. Check all cables, connections, and clamps
- Routine cleaning to ensure netting is free of dust, grease, and other residual matter. Allowing this to accumulate will reduce the fire retardant level

Selecting Protective Netting

The ORFA does not endorse any one type of protective system. These decisions require a comprehensive evaluation of the premise and proposed activities to help determine what system will best protect the public while meeting operational expectations. The ORFA recognizes the efforts of the National Hockey League and the CSA Guidelines and encourages its members to review this information prior to choosing a netting system for any ice facility.

When evaluating netting systems and type of netting to purchase it is important to first determine the intended use of the netting and the type of facility that the netting will be installed. Facilities are usually found in two categories mid to large spectator arenas – over 2500 seats up and community/minor hockey type arenas. In multi-purpose facilities netting systems should be installed so they can be removed or retracted quickly and easily.

For permanent netting the following are key factors should be considered:

- Spectator viewing through the netting
- Durability/strength
- CSA Approval
- Cost

Spectator Arenas

For spectator rinks and those that host a variety of events there are a number of factors to consider.

1. Spectator view through netting
2. Is the net system to be permanent or retractable/removable for other events?
3. Ease of use
4. Durability
5. Cost

Three Types of Netting (with variations in each)

a) Black or white nylon – 2mm strand, 3-1/8" stretch mesh, knotless – 125 to 150lb. break strength

b) Clear monofilament – 1mm strand, 3-1/8" stretch mesh, knotless – 90 to 95lb break strength

c) Black Kevlar – 1.1mm strand, 3" stretch mesh, knotted – 200- 25lb break strength.

For Spectator Arenas There Are Pros and Cons of Each Netting System

Black Nylon – Does not reflect light allowing a better blend and improved viewing

1. Highly visible upon initial spectator viewing and can be distracting but is considered the least distracting of all systems. The eye eventually adjusts and it becomes less noticeable. Television and movie creators choose black as a preferred netting system.
2. Ideal for a permanent or retractable system as it is easy to install and for regular use. Manufactured on the square vs. diamond.
3. Easy to handle, store and hang.
4. Longevity is assured with break strength of 125-150 lbs.

Black Kevlar

1. Less visible than black nylon due to a 1.1 mm strand thickness. Although it is initially visible to the eye, it is not difficult to look through. Knots can be distracting.
2. Works well in permanent and retractable applications. Small strand thickness makes it a small net to store.
3. Easy to handle and hang.
4. Break strength of 200 + lbs. makes for a very strong durable net. Kevlar can be somewhat brittle and care should be taken when retracting and deploying it.

White Nylon

Similar to black nylon, but is more visible to the eye when viewed through. It will "yellow" over time and show dirt and grime.

Clear Monofilament

1. Highly visible when viewed up close. In large arenas where the spectators are seated further back, it is less visible because it is thinner. Clear Monofilament has a tendency to pick up light reflection and glow.

2. Works well in permanent applications where the netting is fixed to a support bar. Clear Monofilament can be troublesome to handle on retractable/removable systems. The netting has a memory and tends to spring back to its original shape. If not properly maintained it may stretch and encroach into the playing area.
3. Difficult to handle and hang in a non-permanent application.
4. Break strength of 90- 95 lbs. allows it to stop pucks, but it is prone to developing holes. In permanent application's they can last 5-10 years: however, given the nature of plastic, over time the mesh will become brittle.

Worker Health and Safety

Protective netting is usually installed at heights above 3m. Ladder or lift use on the ice surface is often necessary for regular maintenance of ceilings, fixtures as well as hanging banners. A detailed Job must be created as the first part of any inspection or repair task.

Ladders and Lifts - Ladders or lifts that exceed 3m must only be used by trained personnel. Use of any lifting device or ladder by users or the general public in a recreation facility should not be permitted. Scaffolding is only to be erected and dismantled by trained competent persons. All such equipment should be secured when not in use by facility staff.

*Contractors should follow any safe operating procedures that the municipality/owner has set for the work being performed.

ORFA Recommendations:

- Facilities should consider the benefits of installing protective netting as recommended by the ORFA. (Refer to ORFA Guidelines for Arena Dasher Board and Shielding Systems)
- Buildings with protective netting in place must confirm in writing the life expectancy of the netting; its flame resistance capability; and that it meets or exceeds the current CSA Guidelines and current Fire code requirements.
- Each facility conducts, no less than once per year; a comprehensive review of installed protective netting; and that this inspection is logged for future reference.
- Develop and implement a regular system of "safe" inspection, cleaning, repair and reporting in all buildings with protective netting.
- Add replacement of protective netting to all facility life-cycle planning schedules.
- Discuss the requirements of protective netting with local fire department prior to purchase and installation of new netting or the status of currently installations.

1.17 Dasher Board Advertising

The 1972 Russia-Canada hockey series introduced the world to arena dasher board advertising. Dasher board advertising is a true revenue generator for all involved. Managers must review planned advertising concepts with users as some organizations have clear policy on acceptable forms and content to be displayed during significant events. Spectator facilities set a maximum of 17-advertisements while community rinks have been known to accept as

many as 50 advertisers. Determining the number of ads and installation format will be influenced by several factors; price, length of advertising contract and expected presentation. It is also recommended that a policy defining what types of advertising is considered appropriate in this public setting be developed prior to ads being sold. The following are four (4) basic dasher board advertisement formats.

Permanent Advertisement or Polycarbonate Advertisement Panels

Accepted in most community arenas as a "full-season" permanent advertisement. They are not scheduled to be removed for one entire operating season and is usually controlled under strict contract. Some facilities control the selling, installation and maintenance of such arrangements while others sub-contract the responsibilities, accepting a percentage of the rental fees. These decisions can be made by determining how much time a facility might afford to the set requirements for a successful program. Advertisements are usually applied to a sheet of ABS material, covered with 8mm (3/16in.) sheet of polycarbonate and then installed in a method to replace existing dasher cladding material. The installation must be smooth to ensure that no player becomes entangled or injured during play.

Vinyl Coated Advertisements

Constructed as a stick-on advertisement made of heavy vinyl these types of ads are placed on to existing dasher cladding thus making them easily replaced when damaged. Having a high clarity for the advertisement while affording flexibility to the facility makes this type of advertising appealing!

Vinyl Banner Advertisement

Usually used for one-time events, a (0.16in.) ad is applied to vinyl banner and then placed over the existing dasher cladding. Replacement ads must be considered to replace damaged units between periods. Such advertising is also considered to have a high clarity value and offers flexibility to the facility.

Rotational & LED Advertisement Systems

This concept is borrowed from the professional basketball circuit. A mechanically driven system is mounted within the dasher board system and protected with a piece of 12.5mm (1/2in.) polycarbonate. Requiring 110v electrical access, these units are controlled by a computer or automated time device that scrolls advertising on demand or use LED lighting. The flexibility of such units is huge as it allows a facility to generate revenues in many different manners. Regardless of which system is chosen; to be successful a detailed maintenance and upkeep schedule must be crafted and adhered to!

1.18 Etching of Dasher Board Shielding

Some facilities have taken to etching dasher board glass as an opportunity to generate revenue. The process involves the selling of a small area on the bottom of the shielding that is etched with a company's logo or in one case an "In memory of" format for past facility users was in place. The etching process, much like the speak-hole and camera hole installation, should be completed prior to the glass actually being tempered. This process takes place on the raw float glass. Once the etching, notching, hole cutting, sizing, etc., is complete, the raw float glass is put into the ovens for final tempering. Note: it should now be realized why it takes so long to have such pieces replaced, and why the cost for such shielding is so high? Although not necessarily recommended, it may be possible for a qualified craftsman to

sandblast a motif or logo on tempered glass but they will be limited to etching a very-thin part of the surface on the glass. If the cut is too deep, the glass will possibly shatter – 2mm (1/32in.) is the maximum possible etching depth!" That the grinding of the glass may take away the smooth surface – causing dirt to build-up, creating a possible housekeeping issue.

Consideration should be given when installing the etching, as to not obstruct site lines – understanding that a direct viewing in front of the etching may not cause visual interference but a side, or angle view, pending the size of the etching could cause some visual impairment. Generally, it is felt that etching of glass, if completed properly, would not weaken the product however, should an incident occur it will be left to the owner to prove that in fact, the etching did not contribute to the shielding failure; in all likelihood, the manufacturer would be dissolved of any liability based on the fact the original materials were altered from the proven creation process of the shielding. Alternatively, some facilities are using a clear plastic sticker that allows for ease of application, repair or removal of the advertising.

1.19 Conversions

Traditionally, the arena market has been split up into large professional buildings; medium sized junior league buildings (Secondary market) and small community rinks. With the increased demand for a wider range of venues and an increase in shows geared to the secondary market, both community rinks and secondary arenas are taking advantage of the ability to utilize their ice surface to accommodate a wider variety of functions in the same fashion as the large buildings. This opens up a wide variety of community service opportunities and revenue generating events that will not only contribute to the bottom line, but also increase the profile of a smaller facility. Although different in many ways the idea of converting ice have some similar characteristics in both large and small buildings.

In Ontario, the Ministry of Labour has investigated accidents that have occurred during conversions prompting facilities to develop Standard Operating Procedures for staff who participate in the conversion process. It is important to note that a recreation facility that is usually mandated by the OHSA Industrial Regulations will most likely shift during conversion to the OHSA Construction Regulations thus requiring a different series of protocols to be implemented. The key to an efficient and successful conversion process in a major arena is coordination of labour. The conversions crew must work in conjunction with the ice crew, housekeeping and building operations must work together for signage and seating set up. The design, selection or modification of an existing dasher system is a key component in the conversion of a facility.

Lift-out sections/panels are a necessity for any multi-purpose arena. Removable sections of the rink boards should be incorporated into a dasher system to allow for move-in and move-out of the event, access for participants and compliance with fire and safety codes. Lift out sections or removable panels should be lightweight and easily demounted. The removable sections could be full dasher panels, small lift-out sections inside of a dasher panel, removable gates or additional bi-fold or double leaf gates. Typically, the removable sections/panels/gates are manufactured from aluminum so that they are light weight and easy to handle. Existing permanent dasher systems can be retrofitted with removable sections or new gates.

Shielding Support Systems – will have an impact on how quickly a rink can remove and reinstall the shielding for an event. Figure skating competitions, concerts, and other spectator

events require the rink shielding to be removed. The support system for a multi-purpose arena should be either a two-piece aluminum support or seamless tempered glass and seamless acrylic system. Two-piece aluminum supports with fastening screws should be avoided as they slow down the conversion process and create a safety issue by having staff up on a ladder on the ice surface to remove screws. Quick release aluminum supports with no screws are preferable. Seamless glass/acrylic systems are also designed for easy conversion. The glass/ acrylic sits in a channel in the boards and has a small polycarbonate shield clip at the top of the glass. If the arena has tempered glass it is recommended that the facility purchase either hand-held suction cup lifters or an electronic suction lifter and forklift attachment. Storage carts can assist in making the conversion process faster and quicker. Carts for storage of the removed dasher sections, lift-out panels and shielding allow the conversion staff to handle and store these items in a safe and secure manner. Most storage carts have heavy-duty caster for easy movement or can be lifted by a forklift.

Ice floor covers – allow an arena to cover the ice and host a "dry" floor activity. Many arenas do not have the time or ability to remove the ice in order to hold an activity that does not require ice. An ice cover will allow arena operators to quickly isolate the ice, insulate from the cold and provide a safe and sturdy surface on which to hold a function. There are a number of options available to arenas today to cover their ice. Depending on the type of facility, type of events, staffing and budgets the operator will need to be considered.

Plywood – provides a low-cost method of covering the ice surface. 20mm (¾in.) or 25mm (1in.) thick plywood, either painted or natural, has been used in many facilities as an inexpensive method of covering the ice. While an economical option plywood can be heavy to work with, can stick to the ice, and can absorb moisture over a period of time. Plywood does not provide much in the way of insulation and when left on the ice for an extended period of time may be difficult to pick up from the ice. Plywood does not provide an engineered slip resistance surface and can be irregular in size and thickness.

Homasote – has been used in ice rinks for many years. Homasote is a 25mm (1in.) thick compressed recycled newsprint/pulp sheet. Most commonly Homasote has an acrylic coating to increase durability and prevent moisture absorption. Homasote is used in all sizes of arenas and provides a cost-effective method of covering the ice. Homasote has an insulating ability that allows the ice to remain covered for a number of days at a time. As it is manufactured from recycled paper products

Homasote can absorb moisture and smells and if not properly handled and stored it can be broken. Over time, depending on the usage the acrylic coating can break down and the sheets will deteriorate.

Plastic – roll ice floor covers are one of the options available to operators. These rolled products provide a durable, stable insulating surface on which to host an event. They are easily cleaned and do not absorb moisture. Installation of these surfaces can be tricky as they need to be interlocked and snapped together with a special tool. While more expensive than plywood or Homasote they are still a cost-effective method of covering the ice for small to mid-size arenas.

Fiberglass – Urethane Composite sheets designed to be light-weight yet durable are used in many large arena facilities. These 25mm (1in.) thick sheets are manufactured from a combination of urethane foam and fiberglass scrim creating a strong light sheet with insulating ability. The top surfaces are engineered to be slip-resistant and chemical resistant. The urethane foam will not absorb moisture. Caution must be used when first installing theses ice floor covers as they are subject to slight contraction from the cold temperatures. A composite ice floor cover can be left on the ice surface for an extended period of time without damage to the ice or the cover. As the composite ice covers do not stick to the ice it is imperative that they have an ice dam or dasher system around the perimeter to lock them into place. Due to the cost of these covers they are usually found in the mid to large arena facilities with 20 or more conversions per year.

All ice covers should be properly palletized and stored in a covered place to properly maintain them and increase their life span. Storage carts are a must as they can be used to wheel the stacks of flooring into place and eliminate the need of a forklift while providing a storage area. Be cautioned that these carts can add 25-30% to the actual purchase price of a flooring system and as such need to be considered as part of the purchasing process.

Netting Systems

Most ice arenas now have some type of spectator netting installed to prevent injury from pucks leaving the ice surface. In many arenas, the netting system is installed permanently and is not easily removed or retracted. With increased demand for alternative use of the ice arenas operators should make sure that the netting system is properly designed and installed for their facility. In the multi-purpose environment netting systems should be installed so that the can be removed or retracted quickly and easily. In many mid-size and large arenas, the netting system is designed to be retracted or removed by using a manual or motorized winch and pulley system. In smaller arenas, the netting can be pulled up by ropes or cables or manually removed for events. The options available to operators range from simple to high-tech, remote controlled truss systems. Each facility should install a netting system that meets their needs, budgets and staffing levels.

Safety Considerations for Conversions

The process of converting a rink for an event can be complicated and requires numerous staff, contractors and processes to take place at the same time. During conversions, there are many people on the floor, driving boom lifts, fork lifts etc. At all times, the safety of the staff and workers needs to be at the forefront of the task!

Forklift Safety - All lift operators should have a valid operator's ticket to work any of the lifts. Mirrors should be installed in loading areas so people can see what is around the corner. Spotters should be used to stop people and direct the operators through the loading dock.

Loose Equipment - must be safely attached to your person or a hard point on the catwalk. This includes radios, belt packs, hand tools, and anything else that could fall from the catwalk or steel girders.

A Fall Arrest/Restraint System - should be in place at facilities with overhead rigging requirements. This consists of steel airplane cable fastened throughout the beams. It allows the riggers to hook on to a line and freely walk along the beams when rigging a production,

hanging banners etc. Any rigging outside the fall arrest system should be done from a boom lift.

Fall-Arrest Policy – facilities must develop and implement a fall arrest policy to guide staff who work at height.

1.20 Managing the Risk: Creating and Maintaining a Safe Ice Arena Environment

History suggests that the first recorded indoor ice hockey game took place on March 3, 1875 at the Victoria Skating Rink in Montreal. Original rink design expectations were often developed by users or the owners of the facilities that has limited or no engineering qualifications thus creating a variety of unofficially accepted designs that had no real basis to support the layout. It can be suggested that all early designs gave no consideration for patron safety. Even today, there is no specific legal obligation to be met when designing and constructing an ice arena board and glass system. As with most significant change in attitude a tragic event is usually the catalyst.

Brittanie Nichole Cecil was a hockey fan who died from injuries suffered when a puck was deflected into the stands at Nationwide Arena in Columbus, Ohio, on March 16, 2002. Because of Brittanie's death, the League implemented mandatory netting at either end of the rink in every stadium to protect spectators from errant pucks. After this tragic event, the media reported on dozens of similar type injuries in semi-pro and community ice arenas. It was further determined that non-ice sports in these same venues also placed fans at risk. Fans being hit while in their seats was no longer considered just part of the game. The courts viewed these types of injuries as unreasonable risk. Rink owners across North America responded by evaluating their facilities and made changes to ensure user and patron safety was in place. Fans originally protested over the reduced sightlines but this dissention soon dissipated and ice rink design was changed forever.

Information shared in this guideline is a consolidation that represents “industry best practice”. As these design factors are embraced by the majority of rink owners they have become a legal standard. This standard is then considered by an authority or by general consent as a foundation of comparison; an approved model; a rule or principle now used as a basis for judgment.

In the original ORFA guideline, a detailed evaluation process was outlined to assist facility management understanding the issues and determining if their rink design was a potential legal risk. Manufacturers of rink products and services responded by developing materials and assisting owners create a safer environment. There are not many buildings that have not taken steps to better protect all who enter their facilities. However, since the first wave of ice arena infrastructure change, a new operational issue has evolved – the lack of maintenance and upkeep to these protective barriers. The ORFA raises awareness to the potential liabilities attached to failing to maintain the integrity of the board, shielding and protective netting system. Litigation surrounding pucks that have escaped through poorly maintained protection barriers have occurred and are nearly impossible to defend.

In this updated guideline, the ORFA promotes the need for ongoing diligence by those responsible in providing and maintaining a safe ice arena environment. Facility management

must adopt an attitude of ongoing diligence. This assertiveness must include risk reduction and ongoing protective measures that are instilled in frontline staff. Because of the diverse design factors and the variety of activities that can occur not one plan can work in every facility. Each building must create and maintain a custom risk reduction strategy that evolves with changes in our industry while embracing advancing techniques and technologies.

The primary objective is to provide and maintain a safe zone for human occupancy from a projectile that has been scientifically proven to travel in excess of 130kph (100mph).

The secondary objective is to provide a play environment that is equal; and, that lends to the primary objective.

Risk Reduction Partners

Frontline staff are key to all facility risk reduction but they can only be effective if trained and supported by facility management. Facility management cannot assume that all staff will have natural risk reduction skills. Creating a team that can effectively manage and control risk can only be accomplished through a set plan that is part of a staff training and development program. A competent person should be capable of reviewing and evaluating the systems integrity through basic inspection and ongoing operational observation. However, requesting assistance from outside expertise should not be considered unreasonable. Facility management can often access risk experts as part of their relationship with their insurance carrier. While having an industry supplier evaluate the current system to help identify actual, potential or possible future issues is reasonable due diligence.

Steps to Risk Reduction

Specific to boards, shielding and protective netting (BSPN) facility management should consider adopting the following platform:

Step One: facility management must be current on industry standards and have a strong understanding of the benefit of BSPN risk management. They must commit to conducting a comprehensive BSPN inspection annually that focuses on life-cycle status, facility design, incident report review and risk awareness program analysis.

Step Two: facility management should consider the benefit of an outside BSPN risk evaluation by outside experts every 5-years.

Step Three: facility management must develop and implement an ongoing BSPN inspection and maintenance program for frontline staff to follow. Staff should be trained to always apply a keen eye throughout their shift to identify hazards and take corrective action. Staff must be reminded of the importance to report each incident and/or accident by filling out the appropriate form(s). It is recommended that a weekly comprehensive inspection and logged report that focuses on the BSPN system occur. The BSPN inspection and maintenance program for frontline staff should include but is not limited to:

1. Board System
2. Shielding System
3. Protective netting

Each must be constantly evaluated for risk reduction opportunities while ensuring protection factors are in place. Risk reduction means finding out what leads to the problem and then

working to reduce, prevent or eliminate these factors. Protective factors are those things that keep whatever it is trying to be prevented from occurring.

Board System

Once installed the boards must be maintained. Industry standard is that the boards are inspected daily. This inspection should be recorded with any issues and repairs being logged. Frontline staff must be trained to understand risk factors and the importance of taking proactive steps to reduce the danger. The inspection should include but is not limited to:

- Broken or loose anchor system
- Poorly functioning door hardware or gates
- Damaged cladding
- Missing or protruding screws
- Loose or missing sill or kick plates

Shielding System

Once installed the shielding must be maintained. Industry standard is that the shielding is inspected daily. This inspection should be recorded with any issues and repairs being logged. Frontline staff must be trained to understand risk factors and the importance of taking proactive steps to reduce the danger. The inspection should include but is not limited to:

- Leaning or loose shields
- Gaps
- Gaskets are in place
- Stanchion condition

Protective Netting System

Once installed the protective netting must be maintained. Industry standard is that the protective is inspected daily. This inspection should be recorded with any issues and repairs being logged. Frontline staff must be trained to understand risk factors and the importance of taking proactive steps to reduce the danger. The inspection should include but is not limited to:

- Inspect netting for tightness/tension
- Inspect netting for wear, holes, torn or cuts
- Inspect netting connection cables and clamps
- Inspect netting mesh hole size

As required under the Fire Code dust, grease and other such matter that is allowed to settle and collect on the netting fabric increases the risk of fire must be regularly removed.

SAMPLE INSPECTION LOG SHEET (To Include)

Year System Was Installed:

Facility Policy for Regular Inspection:

Date:

Inspection Location:

Inspected by:

Inspection	Findings	Action	Notes
Kicker Plate – Condition/Screws			
Plastic Board – Condition/Screws			
Shielding			
Shielding Supports			
Shielding Gasket			
Player Box End Protection			
Door Closing			
Door Hardware			
Advertising			
Protective Netting			
Top Sill – Condition/Screws			
Lift Gate			
GFCI Inspection			
Other			

Design

Facility management's role includes ongoing assessment of facility design. Original construction flaws must be identified and reported to senior administrative staff as part of the annual capital budget discussions. Areas of key concern are where an object might leave the playing surface and enter public unprotected locations. *Example: if a door to the surface is left open can an object leave the bowl are and strike a person?* The review should also reconfirm that the existing systems continues to reflect and meet the programs being offered, changes in equipment or game tactics of historical users. Facility management must consider the benefits from meeting with user groups to discuss pending changes to their sport or activity, facility layout, as well as to review any facility operational concerns. An additional role is to act as advocate during new construction or retrofits to ensure that any new BSPN meets the recommendations in this document.

Risk Awareness Program

The third partner are facility users. They must be aware of the associated risks in the environment they have entered and must also be prepared to accept some responsibility to ensure their personal safety. Signage and ongoing warnings of facility users of the potential hazards associated with a sporting environment are recognized as positive risk reduction tools. Owners must ensure that signs remain prominent and in good condition while warning techniques remain up to date and fresh using the most applicable language found in the facility. The following are shared as examples of positive wording associated with risk awareness statements.

It is strongly recommended that all facilities post the following information in a highly visible area in English and all other applicable languages:

Patrons Entering These Premises Voluntarily Assume All Risks and Dangers Incidental to any Game or Event

Prior to and before the beginning of each period of any sporting event the following announcement is strongly recommended for broadcast in English and all other applicable languages over the facility sound system. Note: some facilities approach local media outlets to design their announcements to ensure a clear precise message is being delivered.

Attention Fans! - "Be aware that pucks/balls/sticks/equipment may leave the surface at any time which can cause serious injury. Please pay attention to the activities on the surface at all times!"

Where tickets are sold it is strongly recommended that the following disclaimer is found somewhere on the portion of the ticket that is retained by the patron. It is also important to note that to be of any legal benefit this information must be easily read by the ticket holder.

The facility owners /arena and/or host club/organization shall not be held liable for any injury that may occur at the event taking place on this date. Each patron assumes all risks and dangers associated with this spectator event/activity.

1.21 Conclusion

It is the responsibility of all stakeholders to take every precaution necessary to provide a safe facility environment. These guidelines are provided in an effort to assist and enhance current risk management program. Only through a commitment to ongoing evaluation of ice arena operations facilities will we be able to take the necessary steps to protect all who work and play in these environments.

Executive Summary

- The ice surface shall be – 25.9m (85ft) wide – 60.9m (200ft) long
- Corner radius shall be – 8.5m (28ft)
- The full and complete ice arena board height for new or retrofitted community ice arenas shall be – (A) 106.7cm (42inches) – 111.7cm (44 inches) when measured from a dry floor to the top of the board sill
- Shielding – from the neutral side of the blue lines to behind the net – (B) 182.9cm (72in.) 15mm (5/8in.) – in the neutral ice area – (C) 121.9cm (48in) 12mm (1/2in.) - the only area that there shall be no shielding is in front of the player boxes
- Total recommended height of the neutral side of the blue lines to behind the net is A + B = 289.6cm (114in.) – 294.6cm (116 inches)
- Total recommended height in the neutral zone is A = C = 228.6cm (90in.) -233.6cm (92inches). The shielding system shall be designed to include not minimal specials size shielding as possible approximately 10-12 pieces
- That protective netting be placed on top of the board and shielding system to a height that full protects all human occupancy in the facility
- The lip leaving the ice surface by the ice resurfacer shall not exceed 5.08cm (2in)
- The step from the dry surface into the player box area or off of the ice surface shall not exceed - 9 inches (228.6 mm)
- Staff training be provided on how to properly inspect, maintain and report BSPN issues
- Facility management to design and schedule a comprehensive BSPN inspection program.

Sources and Resources

- Teenager Struck by Puck Dies: Coroner's report Puck snapped girl's head back, damaging artery http://sportsillustrated.cnn.com/hockey/news/2002/03/20/puck_death_ap/
- Canada Safety Council – The Puck Stops Here http://canadasafetycouncil.org/child-safety/puck-stops-here
- CAN/CSA-Z262.7-04, Guidelines for Spectator Safety in Indoor Arenas, visit www.shopcsa.ca

- 2007 Fire Code can be accessed on e-laws at: http://www.elaws.gov.on.ca/html/regs/english/elaws_regs_070213_e.htm

When considering the need for personal protective equipment (PPE) review the following ORFA Best Practices:

- On Solid Ground http://orfa.com/library/guide_bp/index.htm
- Head Protection for On-Ice Personnel http://orfa.com/library/guide_bp/index.htm
- Canadian Centre for Occupational Health and Safety http://www.ccohs.ca/oshanswers/safety_haz/ladders/
- Mohawk College http://www.mohawkcollege.ca/Assets/Occupational+Health+and+Safety/LadderSafetyProcedures.pdf