

**Structural Condition Investigation, Report and Review for
Sunderland Brock Memorial Arena
20 Park Street, Sunderland, ON
The Corporation of the Township of Brock**



BBA PROJECT NO. 22124

OCTOBER 13, 2022



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PART 1 – INTRODUCTION

1.1 AUTHORIZATION

This structural condition assessment has been undertaken by Barry Bryan Associates, Architects, Engineers, and Project Managers (BBA), for the existing Sunderland Brock Memorial Arena located at 20 Park Street in Sunderland, ON, on behalf of The Corporation of the Township of Brock. Authorization to undertake this study was received from Ingrid Svelnis, Chief Administrative Officer from The Corporation of the Township of Brock.

1.2 OBJECTIVES

The objective of the structural assessment of the Sunderland Brock Memorial Arena, as outlined in the BBA Proposal for Structural Engineering Services for Structural Condition Audits and Reports dated June 15, 2022, are as follows:

1. Perform a visual review of all accessible areas of the building structure and note the condition and status of the items observed.
2. Identify any items of structural concern.
3. Prepare a summary report outlining the structural condition of the building based on the visual review.

1.3 REVIEW METHODOLOGY

BBA completed a non-intrusive, non-destructive, visual review of the building structure on July 26, 2022. During the investigation, the structural and non-structural elements were investigated for evidence of varying levels of deterioration, distress, and/or corrosion and any areas of concern were documented. Vertical access to the existing arena roof framing was achieved via scissor lift operated by Township of Brock personnel.

In brief, the structural assessment included review of the following:

- Surface deterioration and/or corrosion of structural framing.
- Deterioration of structural components including, but not limited to concrete, timber, bearing walls, and slabs.
- Deterioration/cracking of external wall systems.
- Excessively deflected structural elements.

Reference drawings of the existing structure were not available at the time of review. After completion of the review, BBA obtained a drawing package that was issued for approval and dated November 19, 1976, that was used as reference during the completion of this report.

Where reference is made in this report to a Code or other standard, the most recent edition of that reference material was used.

1.4 STATEMENT OF LIMITATION

All comments and observations in this report are based on visual observations made during the inspection on July 26, 2022.

No intrusive or destructive testing or opening of the building system was completed during the inspection. Further, a detailed structural review of the steel connections was not completed.

There are no comments on the components that were not exposed to view.

Any design and/or construction deficiencies not recorded were not evident at the time of the inspection.

PART 2 – BUILDING DESCRIPTION

The Sunderland Brock Memorial Arena is located at 20 Park Street in Sunderland, Ontario. We understand that the original two storey structure was constructed in 1971, with the pre-engineered arena structure being constructed over the existing ice surface in 1977.

The facility includes a single pad arena with an ice resurfacing vehicle room, ground level viewing area, kitchen, change rooms, storage and maintenance rooms, second floor gathering area, and partial basement.

The building roof structure generally consists of pre-finished metal roof deck on cold-form Z-purlins spanning between pre-engineered steel frames above the ice surface. The ground floor consists of composite deck supported by structural steel beams and columns above the basement and a concrete slab-on-grade, and metal roof deck on open-web steel joists (OWSJ) spanning between interior steel beams and exterior load-bearing concrete block masonry.

Where visible, the existing foundation consisted of concrete block masonry pilasters and cast-in-place concrete walls and footings.

PART 3 – OBSERVATIONS

BBA attended the Sunderland Brock Memorial Arena on July 26, 2022, to visually review the condition of the structural building components and exterior façade. A summary of findings is itemized as follows:

3.1 BUILDING INTERIOR

3.1.1 ROOF FRAMING

The existing roof framing system consists of pre-finished metal roof deck on cold formed Z-purlins spanning between pre-engineered steel frames spaced at approximately 20'-0" in the arena (Photo 001). Throughout the remainder of the building, the roof framing is metal roof deck on regularly spaced open-web steel joists (OWSJ) supported on 10" concrete block masonry walls (Photo 002). Observations of the roof framing are as follows:

- Due to the presence of the condition of existing liner system within the arena, the existing pre-finished metal roof deck and cold formed Z-purlins could not be confirmed in this area. Further investigation is required to confirm the structural composition and assess the existing condition of the roof deck/purlins throughout the arena.
- Minor surface corrosion and peeling paint was observed throughout the pre-engineered frames, most notably on the bottom flange members and at connections/bolts (Photos 003). These areas should be cleaned to bare metal and prime painted to prolong the service life of the steel framework.
- Missing and/or damaged lateral support braces and bolts were observed at several locations throughout the pre-engineered steel frames. (Photos 004, 005, 006, 007). These must be replaced to reinstate the structural integrity of the frame.
- Short thread extensions were observed on several of the column baseplate anchor bolts and should be extended (Photo 008, 009, 010). Further review is required to determine the specific requirements and options for repair.
- Lateral support bracing has been removed to accommodate platform at the column in the northeast corner of the arena (Photo 011). Missing bracing components must be replaced to reinstate the structural integrity of the frame.
- It appears that a figure skating support hoist has been installed along one of the frames near the south end of the arena. It is unclear whether the hoist connections or supporting framing have been engineered (Photo 012, 013). Further review is required to determine whether the existing system is sufficient to support the necessary loading conditions.
- Localized staining at suspended ceiling tiles was observed within the second floor community room, indicating potential areas of roof leaks (Photo 014). Further investigation is required to determine the source and severity of any moisture infiltration.
- The OWSJ and metal roof deck appear in good condition with no signs of damage or deterioration (Photo 015).

Generally, the existing roof framing appeared in fair condition with localized areas of repair being required.

3.1.2 BLEACHER SEATING AREA

The existing bleachers are located along the west side of the ice surface and consists of concrete slabs on concrete block masonry units along the lowest level and at each end (Photo 016). Observations of the existing bleacher seating are as follows:

- Concrete damage was observed through the northmost stairs (Photo 017, 018). It is recommended that this damage be repaired to prohibit further structural degradation and eliminate the potential tripping hazard that currently exists.
- Minor cracking and damage was observed throughout (Photo 019, 020). These cracks are not currently a structural concern however, they should continue to be monitored for further deterioration.
- On the underside of the bleachers, minor honeycombing was observed. As the honeycombing is not significant, and no spalling or delamination was observed, no structural action is required. It is recommended that these areas continue to be monitored.

The bleacher seating area generally appeared to be in fair condition.

3.1.3 CONCRETE BLOCK MASONRY WALLS

The existing concrete block masonry walls generally consisted of 8" thick units which acted as the perimeter wind-bearing structure, localized interior load-bearing sections and partition walls. Observations of the existing concrete block walls are as follows:

- Step cracking, peeling paint, staining, evidence of moisture and deteriorated mortar and control joints were observed along each of the perimeter concrete block walls, including at the ice-resurfacers room (Photo 021, 022, 023, 024). In many areas the block wall is unprotected from the elements and is uninsulated.

Continued exposure to the elements and freeze-thaw cycles will lead to more significant structural deterioration in time. Deteriorated mortar joints should be routed and repointed while areas of minor staining, peeling paint, etc. should continue to be monitored for further deterioration. Consideration should be given to painting/sealing the exterior block to add further protection should installation of a proper rainscreen not be viable.

- Significant staining and evidence of moisture was observed on the interior side of the base of the north concrete block wall (Photo 025). The exterior grade in this area appears to be higher than the apron slab, which is likely contributing to the higher moisture levels.

Continued exposure to moisture and freeze-thaw cycles could result in significant damage to the exterior wall. Damaged block should be repaired or replaced and consideration given to improving exterior drainage or adjusting the grade to suit.

- Concrete block partition walls in the viewing area, changerooms and washrooms appear to be in good condition.
- The south block wall was not observable due to obstructions.

The concrete block masonry walls throughout the facility generally appear to be in fair condition. The structural damage observed to date is relatively minor, however given the nature of the exterior wall system, continued monitoring and repairs should be completed to prevent further degradation due to moisture infiltration and freeze-thaw action.

3.1.4 CONCRETE RINK SLAB

The concrete rink slab was exposed at the time of visit. Observations are as follows:

- Cracks were observed throughout the rink slab (Photo 026). These should be repaired to prevent further degradation.
- Previous repairs have been completed to other more substantial areas of cracking (Photo 027). Some areas of repair appear to have performed while others appear to have worsened. Worsening slab conditions may indicate a larger issue at hand. Further investigation and review should be completed to determine a reasonable timeframe for replacement.
- Various areas of damage around concrete inserts were observed (Photo 028). These areas should be repaired.

The concrete rink slab generally appeared to be in fair condition but should continue to be monitored for further degradation which could require full replacement.

3.1.5 MECHANICAL PLATFORMS

Three (3) mechanical unit platforms have been constructed at the northeast, southeast and southwest corners of the arena, respectively. None of the platforms appear to have been engineered and are in various states of deterioration. We recommend that further investigation and analysis be conducted to confirm whether the structures are suitable to support the imposed loading.

3.1.6 CONCRETE APRON SLAB

The reinforced concrete apron slab-on-grade extends around the perimeter of the rink, with some areas not visible due to the presence of rubber floor finish. Existing conditions could not be verified at these locations. Where visible, observations of the existing concrete apron slab are as follows:

- Cracks were observed throughout the apron slab (Photo 029). While not a structural concern at this time, we recommend that these areas continue to be monitored and eventually repaired.
- Minor surface wear and damage were observed at some locations (Photo 030, 031). These areas should continue to be monitored for further deterioration.

Generally, the concrete apron slab is in fair condition.

3.1.7 CONCRETE SLAB-ON-GRADE

The concrete slab-on-grade was only observable in the mechanical rooms, janitor's closet, and basement. Observations of the existing concrete slab on grade are as follows:

- Minor to moderate staining and damage were observed at the slab on grade and housekeeping pads within the mechanical pump room and janitor's closet (Photo 032).
- Minor cracking was observed throughout the basement slab on grade.

Generally, the exposed concrete slab-on-grade areas appeared to be in fair condition. Areas of cracking, staining or damage should continue to be monitored for worsening conditions and repaired if necessary.

3.1.8 SECOND FLOOR FRAMING

Based on our review of the building reference drawings we understand that the second floor framing consists of 2x12 joists at 12" c/c supported on steel beams that frame into steel columns or 10" masonry walls. However, due to the presence of the second floor finish and fixed ceiling below, these areas were not visible for review. Further intrusive investigation is required to confirm the existing conditions.

3.1.9 ROOF FRAMING

Generally, the existing roof framing appears in good condition, where visible.

3.2 BUILDING EXTERIOR

3.2.1 SOUTH ELEVATION

The exterior south elevation generally consists of full height, concrete block masonry walls and a wood framed canopy (Photo 033). We understand that both the wood framed canopy and elevator shaft portion of this area were additions to the original two-storey structure. Observations are as follows:

- Significant checking was observed in most timber columns (Photo 034, 035). Further investigation is required to determine the severity of the checking and to confirm whether there has been any reduction in column capacity.
- It appears that one (1) wood column has been impacted, likely from a vehicle, is damaged/skewed and has shifted off the supporting foundation (Photo 036, 037). This column and associated connections must be replaced or repaired to replaced.
- Various columns appear to have shifted and are no longer centered along the main canopy support beam (Photo 038, 039). Repairs to this area are required to ensure proper connection between the beam and columns.
- Evidence of moisture and staining was observed at the underside of the plywood liner below the canopy framing (Photo 040). Further intrusive investigation is required to confirm the condition of the canopy framing system and whether moisture has adversely affected the structural system.
- Concrete spalling was observed at various locations on the exterior concrete sidewalk (Photo 041, 042). While not a structural concern, loose concrete and void in the slab should be removed and repaired to prevent further degradation and to eliminate potential tripping hazards.
- Various damage was observed at the entryway thresholds (Photo 043, 044). These areas should continue to be monitored for further deterioration.
- Deteriorated mortar joints were observed at some locations along the south elevation. These should be routed and repointed.

The existing structures along the south elevation generally appeared to be in fair condition. However, the wood canopy framing requires to be repaired as various structural components are damaged and have shifted, presumably from vehicular impact loading. Consideration should be given to construction of new exterior bollards to protect against future impacts once the repairs are made.

3.2.2 EAST ELEVATION

The exterior east elevation generally consists of full height, concrete masonry block wall at the original two-storey structure, and concrete masonry block wall with a partial height metal cladding system around the arena (Photo 045). Additionally, an external steel stair provides access to the second level. Observations are as follows:

- Minor surface corrosion and paint peeling was observed on the steel stair (Photo 046). This condition should be monitored, and the stair eventually repainted to protect against more significant corrosion.
- The existing stair acts as an exit from the second floor community room however does not appear to be structurally stable to support the required loading currently prescribed by the Ontario Building Code. While this is an existing condition and may not require upgrade by code, we recommend that this stair be further reviewed for potential upgrades to landing grating and support connections.

- Various areas of damage were observed at the base of the concrete masonry block wall throughout the wall, particularly at downspout discharge locations (Photos 047, 048, 049). Block wall damage and staining should be repaired and consideration given to modifying the downspouts to direct water away from the building structure.
- Caulking at expansion joints was cracked, damaged, or missing in several locations (Photo 050). It is recommended that the caulking be replaced to avoid further damage from water penetration and freeze-thaw action.
- Deteriorated mortar joints were observed at some location along the east elevation, including at the arena plant (Photo 051, 052, 053). It is recommended that cracked joints be routed and repointed with appropriate repair mortar.

The east elevation generally appeared to be in fair condition.

3.2.3 NORTH ELEVATION

The north elevation generally consists of concrete masonry block walls with a partial height metal cladding system above (Photo 054). Located on the north elevation is the ice resurfacers extension, as well as a mechanical unit support structure adjacent to the arena plant. Observations are as follows:

- Surficial corrosion was observed on the mechanical unit support structure (Photo 055). This structure should continue to be monitored.
- Minor deterioration and staining were observed at various locations along the base of the concrete masonry block wall on the north elevation (Photo 056, 057). Recommendations regarding exterior concrete block walls are discussed previously.
- Deteriorated mortar joints were observed at some locations along the block wall (Photos 058, 059, 060). It is recommended that cracked joints be routed and repointed with appropriate repair mortar.
- Damage to the metal roof flashing was observed at the northwest corner of the ice-resurfacers room (Photo 061). This damage should be repaired to protect against further moisture infiltration.

The north elevation is generally in fair condition, however the ice resurfacers concrete masonry block walls appeared to be in poor condition and require to be repaired.

3.2.4 WEST ELEVATION

The exterior west elevation generally consists of concrete masonry block wall with a partial height metal cladding system above (Photo 062). Additionally, an external steel stair provides access to the second level. Observations are as follows:

- Various areas of damage were observed at the base of the concrete masonry block wall throughout the wall, particularly at downspout discharge locations. Block wall damage and staining should be repaired, and consideration given to modifying the downspouts to direct water away from the building structure.
- Deteriorated mortar joints were observed at some locations (Photos 063, 064, 065). It is recommended that cracked joints be routed and repointed with appropriate repair mortar.
- Louver grates/screens are missing at a few locations (Photo 066).
- Minor surface corrosion and paint peeling was observed on the steel stair (Photo 067). This condition should be monitored, and the stair eventually repainted to protect against more significant corrosion.

- The posts for the steel stair are not properly connected to the supporting concrete block structure (Photo 068). Further, the concrete block is not an acceptable foundation. New base connections and foundation structures are required for support of this stair.
- The existing stair acts as an exit from the second floor however does not appear to be structurally stable to support the required loading currently prescribed by the Ontario Building Code. While this is an existing condition and may not require upgrade by code, we recommend that this stair be further reviewed for potential upgrades to landing grating and support connections.

The west elevation generally appeared to be in fair condition. However, the existing second floor exit stair requires to be upgraded or replaced.

PART 4 – CONCLUSIONS AND RECOMMENDATIONS

BBA has completed our structural condition investigation at the Sunderland Brock Memorial Arena on July 26, 2022. The existing building framing, external façade, and other structural elements were visually reviewed, where possible.

The general review of the interior and exterior of the building identified several areas of varying levels of concern which should be addressed to improve the long-term serviceability of the structure. A summary of remedial recommendations is as follows:

RECOMMENDED IMMEDIATE REPAIRS (Repairs to be completed within next 6 – 12 months):

1. Complete repairs to wood canopy at south entrance including replacement of any damaged wood columns, reinstating shifted/damaged connections, confirming extent of column checking and potentially installing bollards to protect against further impact.
2. Complete repairs to exterior exit stairs and associated foundations on the east and west sides of the arena.
3. Reinststate damaged or missing lateral support braces at the pre-engineered frames.
4. Replace missing bolts on pre-engineered frames.
5. Extend short anchor bolt threads at bases of pre-engineered columns.
6. Complete an analysis of figure skating support hoist system and supporting framing.
7. Repair concrete stairs at bleachers.

RECOMMENDED REPAIRS (Recommended to be completed within next 2-5 years):

1. Rout out and repoint deteriorated/open/cracked mortar joints.
2. Repair cracks in rink slab or consider full replacement.
3. Clean corrosion and repaint pre-engineered framing.
4. Repair damage to concrete foundation wall on east elevation.
5. Replace sealant at external expansion joints.
6. Replace guards on west wall louvres.

All masonry repaired noted above must be completed using techniques which best match the original construction of the existing building

We trust the above information meets your requirements. Should you have any further questions, please do not hesitate to contact our office.

Yours very truly,

BARRY BRYAN ASSOCIATES

Architects, Engineers, Project Managers



Matthew Ficara, EIT



Doug McLaughlin, P.Eng.



APPENDIX

PHOTOGRAPHS



Photo 01



Photo 02



Photo 03



Photo 04



Photo 05



Photo 06



Photo 07



Photo 08



Photo 09



Photo 10



Photo 11

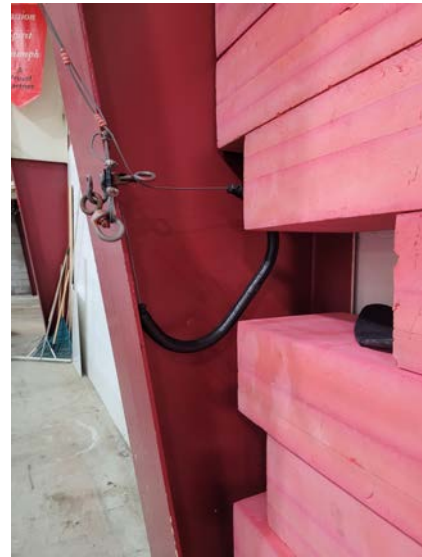


Photo 12

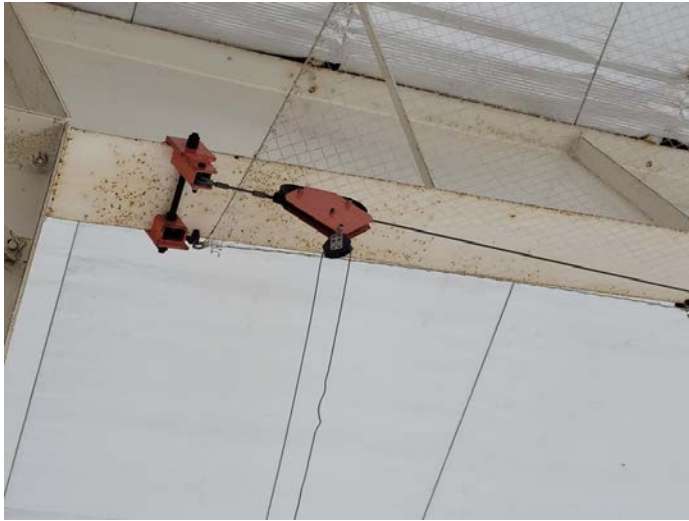


Photo 13



Photo 14



Photo 15

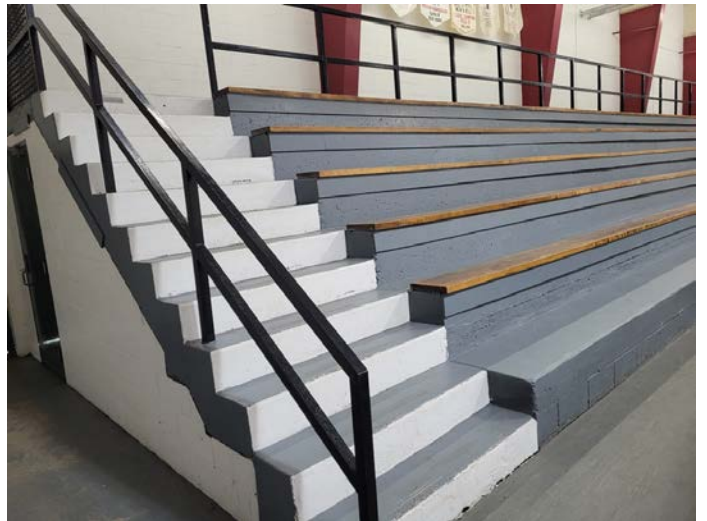


Photo 16



Photo 17

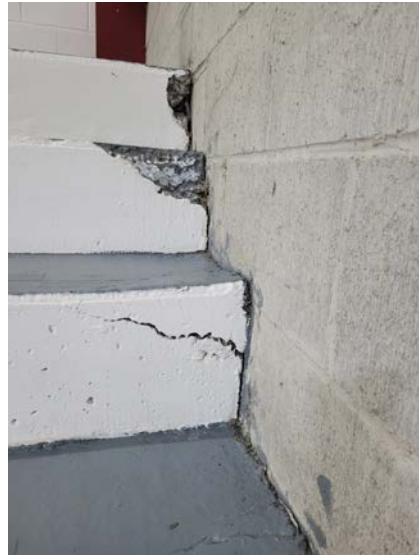


Photo 18



Photo 19



Photo 20



Photo 21



Photo 22



Photo 23



Photo 24



Photo 25



Photo 26



Photo 27



Photo 28



Photo 29



Photo 30



Photo 31



Photo 32



Photo 33



Photo 34



Photo 35



Photo 36



Photo 37



Photo 38



Photo 39



Photo 40



Photo 41



Photo 42



Photo 43



Photo 44



Photo 45

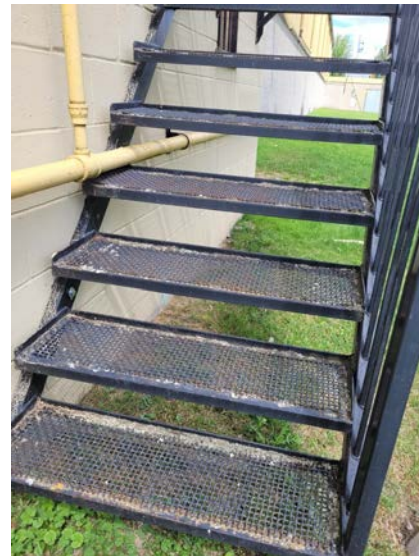


Photo 46



Photo 47

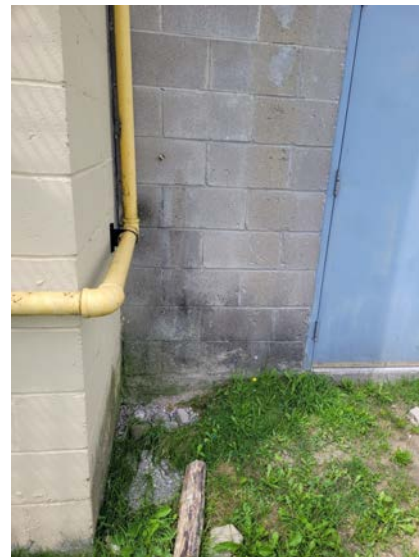


Photo 48



Photo 49



Photo 50

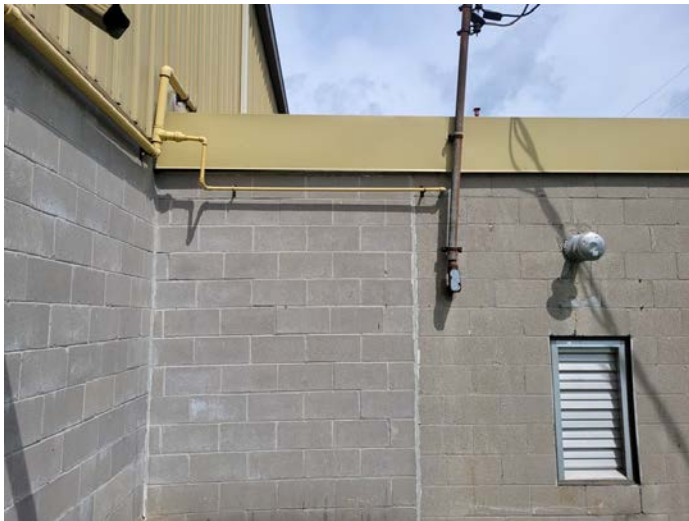


Photo 51



Photo 52



Photo 53



Photo 54



Photo 55



Photo 56



Photo 57



Photo 58



Photo 59



Photo 60



Photo 61



Photo 62



Photo 63



Photo 64



Photo 65



Photo 66



Photo 67



Photo 68