

GRAVITEC

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PROTECTING WORKERS AT HEIGHT

ENGINEERING | TRAINING | EQUIPMENT | TESTING

Note - Sections removed from report not
pertaining to Five Oaks Middle School



FALL PROTECTION HAZARD SURVEY ROOF SURVEY - MIDDLE SCHOOLS

BEAVERTON SCHOOL DISTRICT
BEAVERTON, OR
MAY, 2019

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1.0 Introduction:

1.0 Introduction

Beaverton School District contracted Gravitec Systems Inc. to conduct a rooftop fall hazard survey of 61 of their schools and administrative buildings, located in Beaverton, Oregon. During the course of two site visits, March 24th to March 29th and May 13th to 15th of 2019, Brendon Gobeske, Austin McCutchen, Rae Taylor and Kyle Van Wyck of Gravitec Systems Inc. performed this survey, identifying and prioritizing fall hazards. The survey relied on Andrea Radona and other Beaverton School District personnel to direct Gravitec Systems to identify fall hazards. The main staff of each location provided information on tasks and fall hazards relating to the areas. Other Beaverton School District personnel were involved and consulted as the survey progressed.

This document does not intend to judge current safety practices. Its purpose is to report observed hazards and to compare them to industry best practices and legislative requirements. The ultimate goal is to elevate the awareness of current risks and to provide guidance on how to reduce or eliminate them.

Gravitec's recommendations are drawn from many years of experience, professional affiliations and intimate knowledge of applicable legislation and consensus standards. The primary focus is on practical solutions that enhance the work process. The most effective protection often involves training and personal protective equipment to empower workers to recognize and address the fall hazards by themselves. In some areas, engineered solutions are proposed if the hazard and frequent exposures warrant more positive protection than temporary systems can provide. Engineered solutions require less critical decisions from workers exposed to fall hazards. In all cases where fall protection equipment is required, proper procedures for use and rescue should be written and accompany the fall protection system for the hazard.

Gravitec follows a hierarchy of fall protection when listing recommended solutions for abating hazards. This dictates the order of solutions based on limiting of risks to the worker. The hierarchy consists of first eliminating the hazard, followed by passive fall protection (such as guardrails), then fall restraint, and finally fall arrest. Refer to Section 4.1 for additional details on the hierarchy. In most cases, based upon a balance between the hierarchy, cost effectiveness, user friendliness, and some of the Relative Risk Rating information, Gravitec recommends a hazard abatement solution. In some cases a combination of solutions may be recommended, or, similar solutions may be recommended from which the client can select their preferred option.

The report is broken into sections as detailed in the Table of Contents. Each hazard or topic contains a risk rating matrix, a description of the hazard, present conditions, recommendations for abatement, and rescue options. Section 6.0, in the back of the report, contains tables that summarize the hazards and their conceptual solutions, which are sorted by issue number and by Relative Risk Rating. The table sorted by Relative Risk Ratings is helpful in prioritizing abatement of hazards. Once the report is reviewed and the Beaverton School District has prioritized the hazards to be abated, Gravitec can provide pricing estimates for the solution abatements.

A *Glossary of Terms* can be found in Appendix A.

2.0 Legislation

2.1 General

Fall protection legislation and technology are not always consistent with each other, due to a rapid evolution of available equipment and systems. Sometimes the regulations challenge industry to develop solutions that are not yet in existence. At other times, new systems and components provide a level of protection that exceeds current legal requirements.

While a few states still maintain their own Occupational Safety and Health Administration (OSHA) legislation, the majority have fully adopted the Federal OSHA standards. Oregon State is one of the few states, which maintain their own OSHA legislation with significant adoptions of Federal OSHA, Code 29 CFR 1910.

Oregon OSHA standards contain a variety of approaches to providing fall protection:

- Chapter 437, Division 2: General Occupational Safety and Health
Division 2 focuses on permanent “conventional” fall protection systems such as guardrails and ladders, which are covered in Subdivision D- Walking-Working Surfaces. The only section containing well-developed fall arrest requirements is Subdivision I - Personal Protective Equipment. It is important to note that Oregon OSHA General Occupational Safety and Health standard cites the use of Division 3 - Construction standards when referring to scaffolds and rope descents systems, the need to eliminate inconsistencies between construction and general industry, when it comes to specific terminology and strengths. Division 2, Subdivision B - Adoption & Extension of Established Federal Standards defines construction as alteration, repair, painting and decorating. As such these activities should refer to Division 3 regulations.
- Chapter 437, Division 3: Construction
Division 3 standards address a wider variety of fall protection methods/requirements because of the temporary nature of construction work. Subdivision M provides several fall protection methods, many of them highly skill-oriented, to address the difficult fall protection issues faced during construction activities.

When developing fall protection policies, it is prudent to review the requirements in other jurisdictions. This does not necessarily mean adoption of the most restrictive legislation currently in force since technological improvements are allowing relaxation of some requirements (such as anchorage strengths and fall arresting distances). Expert advice, based on knowledge of the legislative and technological trends, is the best way to predict where agreement will be reached during future harmonization of standards. Corporate policies that are allowed to vary from or improve upon current legal requirements may provide better protection for the employees and a fall protection program that will better meet future regulations.

2.2 Division 2: General Occupational Safety and Health

Oregon OSHA Division 2 – General Occupational Safety and Health applies to most operating activities. While the actual standard should be consulted in detail when determining compliance, some relevant points are paraphrased below:

Subdivision B: Adoption and Extension of Established Federal Standards

1910.12 – Construction Work is defined as construction, alteration, and/or repair, including painting and decorating. This clause brings the requirements of the Division 3 - Construction standards into many Division 2 - General Industry activities.

Subdivision D: Walking – Working Surfaces

1910.21 – Definitions

Designated area - a distinct portion of a walking-working surface delineated by a warning line in which employees may perform work without additional fall protection.

Fall hazard - any condition on a walking-working surface that exposes an employee to a risk of harm from a fall on the same level or to a lower level.

Grab bar - an individual horizontal or vertical handhold installed to provide access above the height of the ladder.

Hole - a gap or open space in a floor, roof, horizontal walking-working surface, or similar surface that is at least 2 inches (5 cm) in its least dimension.

Low-slope roof - a roof that has a slope less than or equal to a ratio of 2 in 12 (vertical to horizontal).

Opening - a gap or open space in a wall, partition, vertical walking-working surface, or similar surface that is at least 30 inches (76 cm) high and at least 18 inches (46 cm) wide, through which an employee can fall to a lower level.

Unprotected sides and edges - any side or edge of a walking-working surface (except at entrances and other points of access) where there is no wall, guardrail system, or stair rail system to protect an employee from falling to a lower level.

Warning line - a barrier erected to warn employees that they are approaching an unprotected side or edge, and which designates an area in which work may take place without the use of other means of fall protection.

1910.22 – General requirements

Loads - The employer must ensure that each walking-working surface can support the maximum intended load for that surface.

Access and egress - The employer must provide, and ensure each employee uses, a safe means of access and egress to and from walking-working surfaces.

Aisles, Passageways, Walkway and Inclines – must be a minimum of 22 inches wide.

1910.23 – Ladders

This section covers in detail the dimensional specifications for ladders across a variety of applications, namely:

a) General requirements for fixed ladders

1. Ladder rungs, steps, and cleats are parallel, level, and uniformly spaced when the ladder is in position for use.
2. Ladder rungs, steps, and cleats are spaced between 10 to 14 inches, measured between the centerlines.
3. Ladder rungs, steps, and cleats have a minimum clear width of 16 inches for fixed ladders.
4. Each employee faces the ladder when climbing up or down, uses at least one hand to grasp the ladder when climbing and do not carry an object or load that could cause the employee to lose balance and fall while climbing.
5. The minimum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in back of the ladder is 7 inches.
6. The side rails of through or sidestep ladders extend 42 inches above the top of the access level or landing platform served by the ladder.
7. Grab bars extend 42 inches above the access level.
8. Fixed ladders having a pitch greater than 90 degrees from the horizontal are not used.
9. Step across distance of not less than 7 inches and not more than 12 inches to the nearest edge of the structure, building, or equipment accessed from the ladders.
10. Fixed ladders without and cage have a clear width of at least 15 inches on each side of the ladder centerline to the nearest permanent object.
11. A minimum perpendicular distance of 30 inches from the centerline of the steps or rungs to the nearest object on the climbing side.

b) Portable Ladders

1. Ladder rungs, steps, and cleats have a minimum clear width of 11.5 inches on portable ladders and 16 inches for fixed ladders.
2. Portable ladders used to gain access to an upper landing surface have side rails that extend at least three feet above the upper landing surface.

1910.25 – Stairways

This section covers all stairways including standard, spiral, ship, and alternating tread-type stairs.

- a) General requirements for fixed ladders
- b) Vertical clearance above any stair tread to any overhead obstruction is at least 6 feet, 8 inches.
- c) Landings and platforms are at least the width of the stair and at least 30 inches in depth.
- d) When a door or gate opens onto a stairway a platform of a minimum of 20 inches, pre-2017 build, and 22 inches post-2017 build has to be provided.
- e) Each stair can support at least five times the normal anticipated live load, but never less than a concentrated load of 1000 pounds at any point.
- f) Are installed at angles between 30 to 50 degrees from the horizontal.
- g) Have a maximum riser height of 9.5 inches.
- h) Have a minimum tread depth of 9.5 inches.
- i) Have a minimum width of 22 inches between vertical barriers.

- j) The height of the stair rail system installed before January 17, 2017 is not less than 30 inches and on or after January 17, 2017 is not less than 42 inches measured from the leading edge of the stair tread to the top surface of the top rail.

Ship Stairs

- k) Are installed at a slope of 50 to 70 degrees from the horizontal;
- l) Have open risers with a vertical rise between tread surfaces of 6.5 to 12 inches.
- m) Have minimum tread depth of 4 inches.
- n) Have a minimum tread width of 18 inches.

1910.28 – Duty to have fall protection and falling object protection

The employer must ensure that each employee on a walking-working surface with an unprotected side, edge, hole (including skylights) or opening that is four feet or more above a lower level is protected by one or more of the following:

- a) Guardrail systems;
- b) Safety net systems; or
- c) Personal fall protection systems, such as personal fall arrest, travel restraint, or positioning systems.

Each employee must be protected from tripping into or stepping into or through any hole that is less than four feet above a lower level by covers or guardrail systems. In the case of ladderway floor holes, the employee must be protected from falling by a guardrail system and toeboards erected on all exposed sides, except at the entrance to the hole, where a self-closing gate or an offset must be used.

For all new fixed ladders that extend more than 24 feet above a lower level, the employer must ensure each is equipped with a personal fall arrest system or a ladder safety system. Safety cages and wells will no longer meet ladder fall protection requirements as of 2036. Ladders with personal fall arrest systems or ladder safety systems must provide rest platforms at a maximum interval of 150 feet.

Ship stairs and alternating tread stairs are to be equipped with handrails on both sides 1910.28(b)(11)(ii). The handrail should be within 30 and 38 inches measured from the leading edge of the stair to the surface of the hand rail 1910.29(f)(1)(i).

For low slope roofs (ratio of less than or equal to 2:12), the fall protection required is dependent on both the frequency of work and distance from the edge of the roof;

- Less than six feet from the edge, all workers must be protected via a method named above,
- Six to 15 feet from the edge of the roof, fall protection must also be implemented unless the work is both infrequent and temporary. At which point a designated area may be used,
- Fifteen feet or more from the edge of the roof, workers must be protected by a guardrail system, safety net system, travel restraint system, personal fall arrest system or a designated area. The employer is not required to provide any fall protection, provided the work is both infrequent and temporary and work rules prohibiting employees from going within 15 feet of the roof edge without using fall protection is implemented.

If fall protection meeting 1910.29 standards is installed and available to use workers must use the protection, with no exemption. Section 1910.28 does not apply during inspections, investigations, or assessing workplace conditions or work to be performed prior to the start of work or after all work has been completed.

1910.29 – Fall protection systems and falling object protection – criteria and practices

Guardrails must be nominally 42 inches high, plus or minus 3 inches above the walking-working surface. The top rail of the guardrail must support 200 pounds applied in any direction without failing or deflecting to a height less than 39 inches. Intermediate members should be installed midway between the top edge of the guardrail systems and the walking-working surfaces (1910.29(b)(2)(i)) and able to support a downward load of 150lbs.

When a designated area is used, an employer must ensure an employee remains within that area while working. Said area must be delineated with a warning line visible 25 feet away from anywhere within the designated area, has of 200lbs minimum bracing strength, which does not sag to less than 34 inches about the walking surface and not higher than 39 inches.

For falling object protection, toeboards should be at least 3.5 inches high and have a clearance of no more than 0.25 inches above the walking- working surface. They must be solid or have no more than a 1-inch opening and be capable of withstanding 50 pounds without failure.

1910.30 – Training requirements

All employees must be trained by a qualified person before being exposed to a fall hazard.

Subdivision I: Personal Protective Equipment

1910.140 – Personal Fall Protection Systems

Section 1910.140 details the performance, care and use for all personal fall protection systems. This section is referenced when considering fall protection design options for any situation.

2.3 Division 3 – Construction

The US Department of Labor - **Occupational Safety and Health Standards for the Construction Industry** applies to new construction activities. While the actual standard should be consulted in detail when determining compliance, some relevant points are paraphrased below:

Division 3 – Subdivision M, Fall Protection

1926.501 – Duty to Have Fall Protection

In Oregon each employee on a walking / working surface 6 feet or more above lower levels, shall be protected from falling by use of a guardrail system, safety net system, or personal fall arrest system. Regardless of height, each employee on a walking/working surface must be protected from tripping in or stepping into or through holes (including skylights) by covers, or equivalent.

It should be noted here Oregon OSHA repealed 1926.501(a) and (b) and replaced with 437-003-1501. This replacement removes the FedOSHA 1926.501(b)(2)(i) exception, *‘When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop a fall protection plan.’*

1926.502 – Fall Protection System Criteria and Practices

Oregon OSHA has tried to simplify the use of the standards by making numbers in Division 2 and 3 the same, where possible. As such Division 3 Subdivision M contains many on the same values for passive fall protection; guardrails, as that of Division 2 Subdivision D and personal fall protection systems as that of Division 2 Subdivision I. Division 3 Subdivision M contains additional information regarding warning lines to that of Division 2.

- Stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion, 30 inches above the walking/ working surface, perpendicular to the warning line, and in the direction of the floor, roof, or platform edge;
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds, and after being attached to the stanchions, shall be capable of supporting, without breaking, the loads applied to the stanchions as prescribed in paragraph (f)(2)(iii) of this section;
- The line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

1926.503 – Training Requirements

The employer shall ensure that each employee who might be exposed to a fall hazard is trained by a competent person to:

- Recognize the hazard,
- Properly understand, erect, inspect, use and maintain all provided fall protection systems,
- Properly understand employee roles in fall protection work procedures, particularly warning line and safety watch systems,
- Know and understand the OSHA 1926 sub part M standards.

The employer must maintain a record, certifying that its employees have received the required training. The employer must retrain employees when required, due to changes in work, fall protection systems, or when employees no longer retain the understanding and skill required by the standard.

Division 3 – Subdivision X, Stairways and Ladders

1926.1051 - General Requirements

A stairway or ladder shall be provided at all personnel points of access where there is a break in elevation of 19 inches or more, and no ramp, runway, sloped embankment, or personnel hoist is provided.

1926.1053 – Ladders

Where the total length of a climb equals or exceeds 24 feet, or where the top of the ladder is higher than 24 over lower levels, fixed ladders shall be equipped with:

- Ladder safety devices; or
- Self-retracting lifelines and platforms at intervals not more than 150 feet apart; or
- A cage or well and lateral offsets of the ladder with landing platforms provided at maximum intervals of 50 feet.

Landing platforms are required where workers must step sideways greater than 12 inches to the access the structure or equipment. The rungs and steps of a fixed metal ladder shall be corrugated, knurled, dimpled, or coated with skid resistant material or otherwise treated to minimize slipping.

3.0 Hazard Ranking

3.1 General

The key objective of a risk assessment is to rank the hazards and aid prioritization of the responses.

A true probabilistic rating of the risks associated with each fall hazard is difficult to accurately develop. To be practical and useful, factors involved in the hazard ranking must be quantitative. Fortunately, factors that are difficult to measure quantitatively may be discounted, as they tend uniformly influence the risk and consequences of an accidental fall. By omitting qualitative factors, a numerical value of risk can be assigned to each hazard, this is referred to as the “Relative Risk Rating”.

The qualitative factors omitted from the “Relative Risk Ranking” and presumed to have a uniform influence on all the hazards observed in the survey include:

- Human Factors; age, experience, health, training, motivation and state of mind. Such factors cannot be accurately determined without a detailed interview and examination of each member of the workforce and could not account for potential change in abilities, health, and state of mind.
- Uncontrollable Environmental Factors. A true assessment of weather's influence on the probability of an accident would require lengthy statistical examination of historical data, regarding weather norms and extremes in the location outdoor work occurs. The result of this analysis shows that weather will equally affect the safety of all outdoor activities, i.e. snow increases the risk of a fall in the parking lot just as much as on top of a scaffold.
- Working Conditions. These greatly influence the probability of accidents, and are mostly controlled by the employer. Working conditions will change over time as maintenance, housekeeping, and safety standards improve or degrade. Nonetheless, the overall condition of the work environment is usually uniform according to the current culture and practices driven or accepted by management. Although the hazard assessment should critique and suggest improvements to working conditions in a global sense, the relative risk ranking only needs to quantify notable variations from the norm to fulfill its purpose of prioritizing the hazards.

With the assumption that Human Factors, Uncontrollable Environmental Factors, and Working Condition factors have a uniform influence on the risks faced by workers and employers, we can develop a “relative” ranking of risks based only on those quantities’ factors.

3.2 Relative Risk Rating: $R = P \times T \times S$

The Relative Risk Rating (R) of any hazard is a number between 0.01 (for negligible risk exposure) and sixty-nine (for extreme risk exposures). It is the mathematical product of the Probability Index (P), Severity Index (S), and Protection Index (T). For the purposes of this survey the hazards have been categorized into five groups relative to their rating.

Relative Risk Rating	Hazard Rating
0 – 10	Low Risk Hazards
11 – 20	Medium Risk Hazards
21 - 30	High Risk Hazards
31 - 40	Dangerous Risk Hazards
41 or more	Extreme Risk Hazards

The relative grouping was designed to match the severity of each hazard. As there is a point at which a hazard cannot become more hazardous, for example a worker falling from 60 feet or 90 feet, the Extreme hazards were designed to include a larger range of the relative risk rating. Dangerous and Extreme hazards are uncommon and should be abated immediately. Medium and High-Risk hazards are serious and should not be dismissed due to the designation note being Extreme or Dangerous.

Probability Index (P) quantifies the possibility that a fall may occur. It is a composite of several measurable factors designed to vary from almost zero (0.1) for improbable accidents, to eleven (11) where a high possibility that a fall may occur. As the value of P tends to zero, so does the chance of an accidental fall. Such a situation would not normally be included in a hazard survey as it is not technically a hazard. A value of P which tends towards 11, indicates almost all measured factors are approaching worst-case value. This situation is rare, yet highly significant.

Protection Index (T) assesses what fall protection is currently in use and factors the Risk Rating accordingly. Many identified hazards have some level of fall protection applied. Any hazard that has excellent protection such as guardrail; which would eliminate a fall, will be included in the calculation, ultimately reducing the Risk Rating to a negligible value. For example, a hazard that is high severity and high probability will be reduced to one tenth, if the existing system is excellent and prevents a fall. If the same situation incorporates a compliant fall arrest system the calculation will be multiplied by 0.25, as fall arrest systems (even compliant systems) have an elevated level of risk. Hazards where the existing fall protection needs improvement (but is not life-threatening, determined by the Severity Index) will be reduced to three quarters of the original number. Fall hazards that are not protected or have systems that are life-threatening will not be reduced.

Severity Index (S) quantifies the severity, cost or consequences of an accidental fall. It varies from one (1) for minor consequences to five (5) for extreme consequences. The value given for S is determined by the potential fall height. A full explanation of this is given in 3.2.1.

The highest ranking will occur where an extreme hazard has a frequent probability of occurring and is unprotected. The usual lowest rankings (< 1) will occur where a fall accident is improbable, has minor consequences and has excellent protection. The Relative Risk Rating is accompanied by the Probability Index, making a comparison between high hazards with minor

probability and minor hazards with high probability possible. This will reflect the attention these combinations should receive when developing a fall protection program.

3.2.1 Probability Index (P)

The Probability Index is a relative measure of the risk of an incident occurring at the hazard. Excluding the human factors, uncontrollable environmental factors and working conditions; discussed in section 3.1, the Probability Index is predominantly dependent on seven measurable factors:

- The **Frequency (F)** of the exposure, how often workers are at each location.
- The **Occurrence (O)** of the exposure, how many locations the hazard is found.
- The **Proximity (X)** of the exposure, how many feet is the worker from the hazard.
- The **Duration (D)** of the exposure, how long workers are exposed during each visit.
- The **Interference (I)** from other workers in the immediate vicinity.
- The **Security (C)** provided by the nature of the work environment, level flat surface or structural climbing.
- The **Environment (E)** under which the work is performed, indoors or outdoors.

Each of these seven effects is given a numerical value, which collate to produce the Probability Index. The system is designed to deliver a quantitative value, providing the ability to rank hazards irrespective of their diversity. The rating calculated for each hazard will then assign that hazard to one of five categories.

Probability Index	Probability Rating	Description
Improbable	1.0 -2.0	The likelihood of a serious fall accident is very low, almost non-existent
Unlikely	2.1 -3.0	An accident is unlikely, but the possibility should be addressed
Low	3.1 -4.0	There is a low degree of possibility that a fall accident may occur at this hazard
Medium	4.1 -5.0	There is a medium degree of possibility that a fall accident may occur at this hazard
High	5.1 or more	There is a high degree of possibility that a fall accident may occur at this hazard

There are occasional extreme events with values greater than 5.1. Values 5.1 and greater are for situations where most of the parameters are simultaneously “worst case” (such occurrences are both rare and serious).

3.2.1.1 Frequency Index (F)

This index quantifies how frequently worker(s) would be exposed to the particular fall hazard.

Frequency Index (F):		
Term	F	Description
Never	0.1	Never been accessed
Occasionally	1.1	Worker(s) at the location once every 2 to 10 years
Annually	1.2	Worker(s) at the location or task is done once or twice per year
Quarterly	1.3	Worker(s) at the location 3-5 /yr; quarterly maintenance, “as-needed” work
Monthly	1.4	Worker(s) at the location 6-12 /yr, monthly maintenance, “as-needed” work
Weekly	1.5	Worker(s) at the location 13-52 /yr; weekly maintenance. “as-needed” work
Daily	1.6	Worker(s) at the location on a daily basis or once per shift

3.2.1.2 Occurrence Index (O)

This index quantifies how often the particular hazard is found at the facility being studied.

Occurrence Index (O):		
Term	O	Description
Unique	1.1	Hazard occurs at only one location
Rare	1.2	Hazard occurs at two locations.
Common	1.3	Hazard occurs at 3 - 10 locations.
Very Common	1.4	Hazard occurs at 11 - 50 locations.
Recurring	1.5	Hazard occurs in more than 50 locations.

3.2.1.3 Proximity Index (X)

This index reflects how close worker is performed to the hazard, as follows.

Proximity Index (X):		
Term	X	Description
Far	1.0	Worker(s) from 11 to 15 feet of an improperly guarded fall hazard
Near	1.1	Worker(s) from 6 to 10 feet of a fall hazard
Close	1.2	Worker(s) from 3 to 6 feet of a fall hazard
Very Close	1.3	Worker(s) from 1 to 3 feet of a fall hazard
Immediate	1.4	Worker(s) directly exposed to a fall hazard or working from a ladder

3.2.1.4 Duration Index (D)

This index quantifies how long workers spend at the location each time they are exposed to the hazard. The determination of man-hours must consider both the number of workers and the time spent at the hazard.

Duration Index (D):		
Term	D	Description
Brief	1.1	Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Short	1.2	Worker(s) at the location from 0.1 to 1.0 man-hours per occurrence, on average
Medium	1.3	Worker(s) at the location from 1 to 8 man-hours per occurrence, on average
Long	1.4	Worker(s) at the location from 8 to 40 man-hours per occurrence, on average
Extensive	1.5	Worker(s) at the location continuously or more than 40 hours per project

3.2.1.5 Interference Index (I)

This index examines the effect multiple workers at the same location may have on each other. It is assumed multiple workers with may interfere with each other's movements or create trip or other hazards that are not seen by the other workers around them.

Interference Index (I):		
Term	I	Description
Independent	1.1	All workers are separated or there is only one worker
Dependent	1.2	Two workers on the same work platform
Multiple	1.3	Multiple workers in close proximity

3.2.1.6 Security Index (C)

This index measures the security of the platform or structure that the worker is using to support their weight and the easy to which the worker can travers the area.

Security Index (C):		
Term	C	Description
Excellent	1.0	Solid, flat, secure & stable, designed and engineered walking/working surface
Fair	1.1	Not designed for walk & work or outdoor / worker can still navigate relatively easily
Poor	1.2	Difficult structure, I-beams, bracing, structural climbing, pipe racks, trusses etc.
Vertical	1.3	Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar

3.2.1.7 Environment Index (E)

This index measures whether work is being performed in an inside or outside work environment.

Environment Index (E):		
Term	E	Description
Ideal	1.0	Indoor, climate controlled, clean, dry; worker(s) have adequate environmental PPE
Good	1.1	Some housekeeping, slipping, or tripping hazards
Variable	1.2	Uncontrolled variables or weather may compromise worker comfort & stability
Extreme	1.3	Continuously slippery, steep, extremely difficult or uncomfortable to navigate

3.2.2 Protection Index (T)

The protection index reduces the Risk Rating number according to the quality of existing fall protection.

Protection Index (T):		
Term	T	Description
Excellent	0.1	Adequate guardrails or fall restraint. No fall possible, no visible concerns
Good	0.25	Adequate fall arrest. Acceptable equipment, MAF, clearance, rescue plan, etc.
Poor	0.75	Protection needs improvement. Not life threatening. Swing fall, compatibility, etc.
None	1.0	No fall protection or system is life threatening
Dangerous	1.25	Existing system increases fall hazard

Hazards that have fall protection systems that prevent falls (guardrails/barricades, fall restraint) will be reduced significantly as the system has abated the hazard. Hazards that use fall arrest systems are not reduced by the same amount as fall arrest systems have an inherent level of risk associated with them, even if the system is perfect. Hazards whose system needs improvement are slightly reduced, providing that the issue is not life threatening. Hazards that have no fall protection or whose fall protection is inadequate or non-existent is not reduced.

3.2.3 Severity Index (S)

The Severity Index is a relative measure of the severity, cost or consequences of an accident.

The following table lists the five classifications of Severity used to aid risk ranking. This index assigns a numerical value of risk to a range of potential fall heights, considering the effect a fall from that height within that range would have on the body. It should be noted here, that there is always a risk of a fatality or serious injury in any fall, regardless of height, the index defines the likely severity based common injuries sustained from these heights. Where other factors such as unguarded machinery or hazardous materials in the landing area need to be accounted for, the assessor would select the appropriate index based on the description rather than the height.

Severity Index (S):		
Term	S	Description
Minor	1	0 to 4 ft: May cause minor injury requiring first aid or medical attention
Moderate	2	>4 to 10 ft: Likely to cause moderate injury requiring first aid or medical attention
Severe	3	>10 to 16 ft: Likely to cause severe injury or result in temporary disability
Critical	4	>16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death
Extreme	5	>30 ft: extremely likely to cause permanent disability, or death

3.3 Comparison to Other Risk Ranking Systems

The Relative Risk Rating system uses easily measured factors to derive a relative risk ranking of the hazards observed. The values of the various indices can be adjusted as needed to provide a reasonable spread of data for the hazards observed during this survey. The developed ratings are therefore only valid for relative ranking of the hazards observed within this report and may not be directly comparable to the numerical rankings developed in other surveys unless identical indices, methodology and assumptions are applied.

3.4 Beaverton School District Assumptions and Simplifications

Due to the significant number of buildings being assessed in this survey and the similarities of the hazards being ranked, a number of assumptions are required to maintain standardization of tasks and therefore hazard exposure. Gravitec has also applied some simplifications by removing commonalities from the Risk Ranking in order to simplify and reduce the volume of the reports.

3.4.1 Assumptions

- 1) A theoretical custodian is performing all the tasks - Gravitec has taken information regarding durations spent on tasks given by the custodians and averages these times. If all things being equal, one custodian takes a significantly longer than another to change a fan belt, then the increased duration will increase the probability index. This would then result in that hazard receiving a higher risk rating, thus more priority being given to the fall protection plan. If the custodians were then to switch places then the original lower risk task would have a sudden increase in risk. The theoretical custodian performing the work eliminates this issue.
- 2) All roofs are accessed once per week for drain checks. It was indicated by Beaverton School District that all custodians are expected to perform weekly drain checks and as such this has been included the risk rating. In some cases, lower roofs can be seen without having to be accessed; this is noted in the relevant assessments.
- 3) If a custodian reported a roof to be 'too dangerous' to access, Gravitec again employed the theoretical custodian from assumption 1. If the roof was assessed assuming it was never accessed, the frequency (F) would be 0.1, rather than the work program of weekly access for a drain check, giving a factor of 1.5. This would significantly reduce the probability index, suggesting the 'too dangerous' roof is in fact less dangerous than a roof the custodian is happy to access.
- 4) Where the fall height varies due to slopped ground or a stair or ramp access point the worst-case scenario is taken every time.

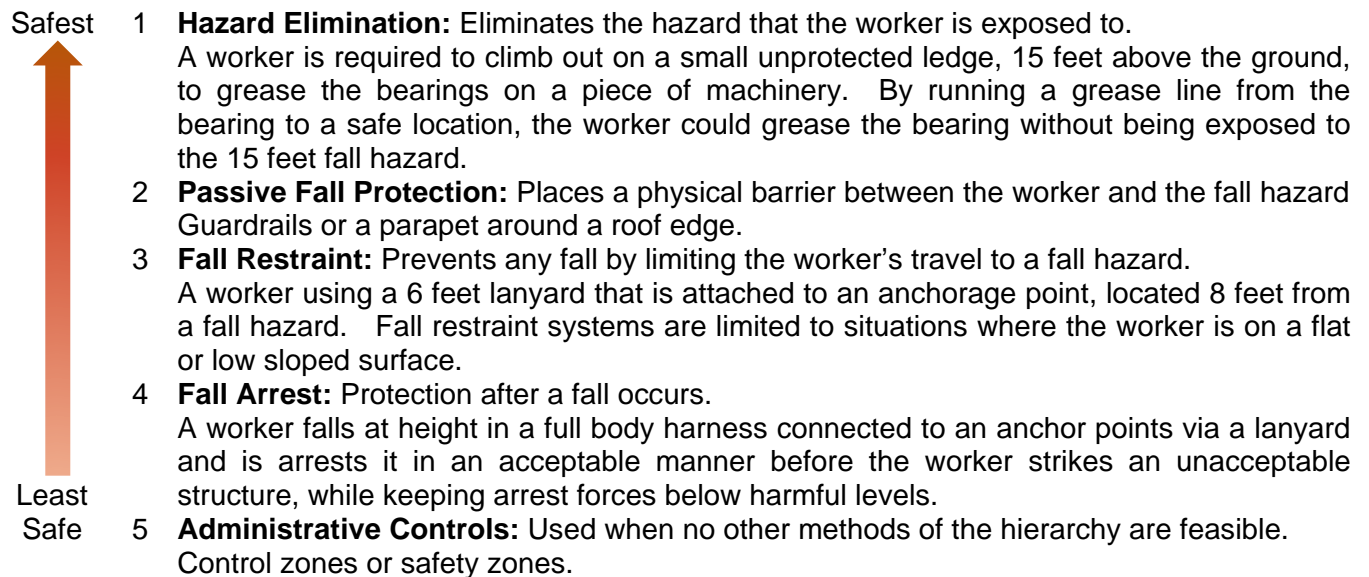
3.4.2 Simplifications


- 1) The task of cleaning gutters is performed from a ladder never less than eight feet and never more than 15 feet from the ground. The only variation in this task was the length of guttering being cleaned. If this task is included in the report, larger schools would have an artificially inflated Risk Rank, simply because there is a greater linear quantity of guttering. Whereas, in reality this hazard should rank the same at all schools and be addressed with the same urgency, irrespective of guttering length. To that end, assuming all workers maintain the same pace as each other the Relative Risk Ranking for cleaning guttering from a ladder is 16.86. This shall be added to the ranking, but should be applied to all schools which have guttering. Gravitec recommends gutter covers be places at all schools that have gutters. Schools closer to trees should be prioritized, but they should be added to all schools to eliminate or reduce the need for a custodian to use a ladder.
- 2) All fall protection currently present on the roofs should be tested to verify their load capacity. Gravitec Engineers performed cursory observations and notes a concern in the relevant roof report, where necessary. However, this does not negate the need for an anchor specific assessment involving testing.
- 3) Rescue options: If self-rescue is not possible, the primary rescue resources at all Beaverton facilities should be calling 911 and notifying a trained emergency responder. A fall from a roof top results in the worker being standard in vertical terrain, which requires a technical high angle rescue. Notifying a trained emergency responder along with the location of the closest medical facility should be adopted into a written fall protection plan.
- 4) All buildings will document and implement a work procedure detailing safe work practices for accessing and hoisting materials on to the roof (workers shall always maintain three points of contact when climbing on the ladder, all tools and equipment shall either be placed in work belts or hoisted on to the roof, do not store equipment behind the fixed ladder, etc.)
- 5) When a mechanical unit on a roof appears to have service requirements atop, which would require a worker's feet to be four feet or more from the surface of the roof, the unit is discussed as a hazard. If there are mechanical units which do not have service requirements atop or would not need a worker's feet to be four feet or higher from the roofs surface that units is not discussed. It should therefore be presumed that a mechanical unit not discussed in the reports presents no fall hazard.

4.0 Mitigating Fall Hazards

4.1 Fall Protection Hierarchy

Once all information has been gathered and the hazards have been assessed and ranked, the next step is to determine the type of fall protection system to use at the hazard site. When determining the best solution, Gravitec recommends using the fall protection hierarchy. The fall protection hierarchy is an industrial standard, which should always be consulted when addressing a fall hazard, as it will result in the safest solution possible for a worker. The hierarchy divides fall protection solutions into five different categories the aim being to provide a fall protection solution in the lowest possible category, as this will provide the safest possible work environment.



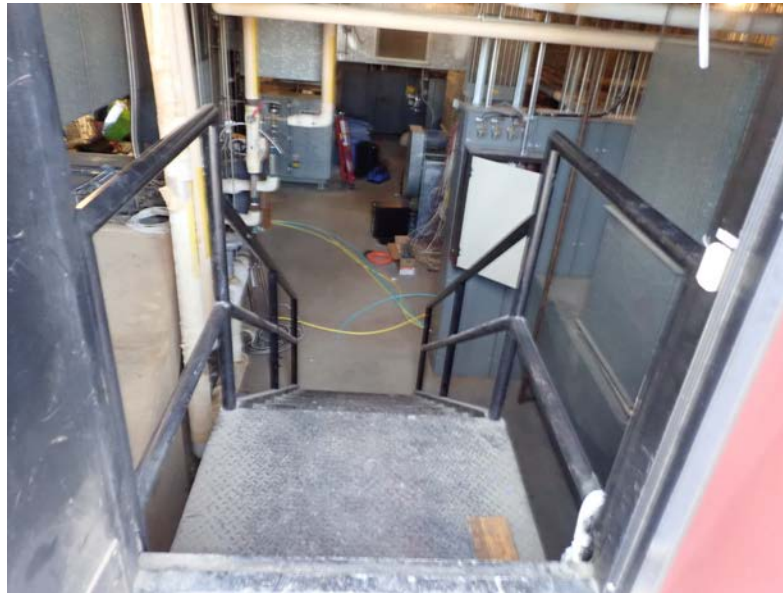
Date:	07-10-2019
Job Number:	110378
Company Name:	Beaverton School District
Address:	Five Oaks Middle School, 1600 NW 173rd Ave, Beaverton, OR 97006
Location/ GPS:	
Phone Number:	(503) 356-2600
Surveyor/ Auditor Name	Brendon Gobeske

Location	Five Oaks Middle School Roof One
Slope of Roof	Flat < 2:12
Roof Surface	EPDM
Method of Access	Other
Other	Standard Door
Roof Access Area	Penthouse
Fall Hazards	Edges
Edge Height (ft)	19

Hazard Survey

Location Five Oaks Middle School

Area Roof One: Access



Roof One: Access

Relative Risk Rating:	1.10
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.1 Unique - Hazard occurs at only one location
Proximity:	X = 1.0 Far - Worker(s) from 11 to 15 feet of an improperly guarded fall hazard
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.0 Ideal - Indoor, climate controlled, clean, dry; worker(s) have adequate environmental PPE
Probability Score	2.20
Probability:	2.1 - 3.0 Unlikely - An accident is unlikely, but the possibility should be addressed
Protection:	0.25 Good - Adequate fall arrest; acceptable equipment, MAF, clearance, rescue plan, etc.
Severity:	Moderate - >4 to 10ft: Likely to cause moderate injury requiring first aid or medical attention

Hazard Description

Risk Rating Level

Low Risk Hazard

Task:

Workers use this door as the primary access point for Roof One. This door is accessed via a ship ladder and transition platform with guardrail. Roof One has the following tasks: clean drains, remove balls from roof. The roof itself also requires maintenance and repair on a sporadic basis. The roof does not contain any HVAC units.

Hazard:

When on the top transition platform workers are exposed to a 6' fall of the side edge of the guardrail.

Current Approach:

Guardrails are used to protect workers from falling off the sides of transition platform. This guardrail system is not OSHA compliant because the mid-rail is not located halfway between the top rail and the platform's walking surface.

Hazard Abatement

Conceptual Solution 1:

Modify Existing Guardrail. Install new mid-rails at this location and locate them half way between the top-rail and the platform's walking surface. Ensure the mid rail meets OSHA strength and dimensional requirements. KeeSafety makes a module guardrail component that will clamp to the existing vertical rails. Using these components will eliminate the need to cut or weld components to the existing guardrail system.

Hazard Survey

Location Five Oaks Middle School

Area Roof One: Edge



Roof One: Edge

Relative Risk Rating: 27.45	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.5 Recurring - Hazard occurs more than 50 locations.
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to fall hazard or working from a ladder
Duration:	D = 1.2 Short - Worker(s) at the location from 0.1 to 1.0 man-hours per occurrence, on average
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 5.49	
Probability:	5.0 and greater High - There is a high degree of possibility that a fall accident may occur at this hazard
Protection:	1.25 Dangerous - Existing System Increases Fall Hazard
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Hazard Description

Risk Rating Level	High Risk Hazard
Task:	Roof One has the following tasks: clean drains, remove balls from roof. The roof itself also requires maintenance and repair on a sporadic basis. The roof does not contain any HVAC units.
Hazard:	Workers are exposed to the roof edge (19' fall hazard) while performing maintenance, accessing equipment and cleaning roof drains.
Current Approach:	Where possible, workers maintain a minimum 10' distance from the roof edge. This is not always possible depending on the task. On average the current parapet wall varies between 18" and 37" and is non 1910.29(b)(1) complaint. The parapet being present gives workers a false sense of security. There are small sections of the parapet wall that are 39" tall. The very small percentage at which these sections occur is negligible and not considered in the solutions section of this report.

Hazard Abatement

Conceptual Solution 1:	Design and install guardrails to protect workers from a fall over the currently unprotected edges. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the roof will allow workers to access their work area without being exposed to a fall hazard.
Conceptual Solution 2:	Designated Area and Restraint Horizontal Lifeline (HLL): Install warning lines at meeting OSHA's requirement 15 ft back from the building's unprotected edge. Develop a work procedure which documents the area inside these warning lines as a Designated Area. OSHA does not require workers to use fall protection when working from or accessing a designated area. This would be combined by an engineered and installed fall restraint HLL to protect workers when working outside of the designated area.
Conceptual Solution 3:	Engineered Fall Restraint HLL: Engineer and install a fall restraint HLL to protect workers who are accessing and working on the entire area of the roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach to this system with a vertical lifeline (VLL) with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and they are restrained from accessing any of the fall hazards.

Location	Five Oaks Middle School Roof Two
Slope of Roof	Flat < 2:12
Roof Surface	EPDM
Method of Access	Fixed Ladder
Ladder Height	11
Roof Access Area	Hatch - Grab Bar Only
Fall Hazards	Edges
Edge Height (ft)	31

Hazard Survey

Location Five Oaks Middle School

Area Roof Two: Ladder Access



Roof Two: Ladder Access

Relative Risk Rating: 13.08	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.1 Unique - Hazard occurs at only one location
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to a fall hazard or working from a ladder
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.3 Vertical - Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 4.36	
Probability:	4.1 - 5.0 Medium - There is a medium degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Severe - >10 to 16 ft: Likely to cause severe injury or result in temporary disability

Hazard Description

Risk Rating Level

Medium Risk Hazard

Task:

This ladder/hatch is an access point for Roof Two, and is used for the following: moving equipment and materials, fixing roof leaks, drain checks, cleaning drains, and removing balls from the roof. Equipment for maintenance and repair is also brought through this hatch.

Hazard:

Workers are exposed to a maximum fall of 17' down the ladder (11' down ladder) and over the edge (6' over floor edge) of the midlevel floor's guardrail to the ground level floor. Workers are also exposed to the same 17' fall hazard when walking and working by the open roof hatch.

Current Approach:

The ladder/hatch has no guardrail and no swing gate, as per 1910.28 (b)(3)(iv) - Each employee is protected from falling into a ladderway floor hole or ladderway platform hole by a guardrail system and toeboards erected on all exposed sides, except at the entrance to the hole, where a self-closing gate or an offset must be used.

The distance from the centerline of the rungs to the ladder hatch is 15 "

Hazard Abatement

- Conceptual Solution 1:** Hatch Guardrail/Swing Gate: Design and install guardrail sections to protect workers from a fall through the ladderway that meets OSHA's dimensional and strength requirements. Install a pre-manufactured self-closing safety gate in front of the ladder top access location. These safety gates will protect workers from falling through the top opening to the floor below. Ensure the safety gate is attaching to structure of sufficient strength, per the gate manufacturer's and OSHA's requirements. Gravitec recommends using self-closing gates as they close on their own, so their effectiveness is not contingent on workers' actions.
- Conceptual Solution 2:** Ladder/Platform Side Guarding: Gravitec recommends installing an extended guardrail system to prevent workers from falling over the midlevel floor guardrail. Ensure the guardrail system meets OSHA strength and dimensional requirements. This solution is not required by OSHA, as the fall hazard is less than 24'. Gravitec is recommending this solution because it would reduce the fall hazard from 17' to 11' thus reducing the severity of the injury a worker could incur.
- Conceptual Solution 3:** Material Davit: Install a Davit Arm/Crane with guardrail, located at the edge of the roof in an accessible location. The weight of the equipment being brought onto the roof is needed to determine the load capacity of the Davit arm needed. The arm would be placed at the edge of the roof to prevent motors, compressors and other large parts getting stuck or damaging the roof hatch. This would also remove the need to transport heavier items through the school and possibly up staircases. The Davit Arm/Crane shall be accompanied by a guardrail meeting OSHA's dimensional and strength requirement, which would protect a worker using the hoist from the roof edge.

Hazard Survey

Location Five Oaks Middle School

Area Roof Two: Edge



Roof Two: Edge

Relative Risk Rating: 21.96	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.5 Recurring - Hazard occurs more than 50 locations.
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to fall hazard or working from a ladder
Duration:	D = 1.2 Short - Worker(s) at the location from 0.1 to 1.0 man-hours per occurrence, on average
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 5.49	
Probability:	5.0 and greater High - There is a high degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Notes: The height of the fall hazard varies at this location from 13' (90%) to 31' (10%).

Hazard Description

Risk Rating Level High Risk Hazard

Task: Roof Two has the following tasks: change the HVAC filters, maintain HVAC units, clean drains, change fan belts, and remove balls from roof. The roof itself also requires maintenance and repair on a sporadic basis.

Hazard: Workers are exposed to the roof edge (13' to 31' fall hazard) while performing maintenance, accessing equipment and cleaning roof drains.

Current Approach: Where possible workers maintain a minimum 10' distance from the roof edge. This is not always possible depending on the task.

Hazard Abatement

Conceptual Solution 1: Guardrails: Design and install guardrails to protect workers from a fall over the currently unprotected edges. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the roof will allow workers to access their work area without being exposed to a fall hazard.

Conceptual Solution 2: Designated Area and Restraint Horizontal Lifeline (HLL): Install warning lines at meeting OSHA's requirement 15 ft back from the building's unprotected edge. Develop a work procedure which documents the area inside these warning lines as a Designated Area. OSHA does not require workers to use fall protection when working from or accessing a designated area. This would be combined by an engineered and installed fall restraint HLL to protect workers when working outside of the designated area.

Conceptual Solution 3: Engineered Fall Restraint HLL: Engineer and install a fall restraint HLL to protect workers who are accessing and working on the entire area of the roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach to this system with a vertical lifeline (VLL) with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and they are restrained from accessing any of the fall hazards.

Location	Five Oaks Middle School Roof Three
Slope of Roof	Flat < 2:12
Roof Surface	EPDM
Method of Access	Fixed Ladder
Ladder Height	20
Roof Access Area	Hatch - Grab Bar Only
Fall Hazards	Edges
Edge Height (ft)	40

Hazard Survey

Location Five Oaks Middle School

Area Roof Three: Access Ladder



Roof Three: Access Ladder

Relative Risk Rating: 17.44	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.1 Unique - Hazard occurs at only one location
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to a fall hazard or working from a ladder
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.3 Vertical - Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 4.36	
Probability:	4.1 - 5.0 Medium - There is a medium degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Notes: OSHA does not require workers to use fall protection on fixed ladders that are less than 24'. This ladder has a fall distance of 20' and does not require fall protection.

Hazard Description

Risk Rating Level Medium Risk Hazard

Task: This ladder/hatch is an access point for Roof Three, and is used for the following: moving equipment and materials, changing the HVAC filters, maintaining the HVAC systems, changing fan belts, fixing roof leaks, drain checks, cleaning drains, and removing balls from the roof. Equipment for maintenance and repair is also brought through this hatch. Two HVAC units are located on this roof. This ladder system consists of a bottom 9' ladder, a transition landing platform, and an upper 11' tall ladder.

Hazard: Workers are exposed to a maximum fall of 20' when climbing on the ladder. This fall consists of falling an additional 9' over the edge of the landing platform located 11' to the ground level. Workers are also exposed to the same 20' fall hazard when walking and working by the open roof hatch.

Current Approach: The hatch has no guardrail and no swing gate and the transition landing platform has no swing gate, as per 1910.28 (b)(3)(iv) - Each employee is protected from falling into a ladderway floor hole or ladderway platform hole by

a guardrail system and toeboards erected on all exposed sides, except at the entrance to the hole, where a self-closing gate or an offset must be used.

Hazard Abatement

Conceptual Solution 1: Hatch Guardrail: Design and install guardrail sections to protect workers from a fall through the ladderway that meets OSHA's dimensional and strength requirements. Install a pre-manufactured self-closing safety gate in front of the ladder top access location. These safety gates will protect workers from falling through the top opening to the floor below. Ensure the safety gate is attaching to structure of sufficient strength, per the gate manufacturer's and OSHA's requirements. Gravitec recommends using self-closing gates as they close on their own, so their effectiveness is not contingent on workers' actions.

Conceptual Solution 2: Replace existing ladder and landing platform with a single ladder: In addition to Solution 1. Given there is not enough room to place a swing gate on the existing landing platform Gravitec recommends replacing the existing ladder with one meeting OSHA's dimensional requirements.
FS Industries (<http://www.fsindustries.com>) sells OSHA compliant fixed ladders ranging from 3 ft to 29 ft in height.

Hazard Survey

Location Five Oaks Middle School

Area Roof Three: Edge



Roof Three: Edge

Relative Risk Rating: 29.75	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.5 Recurring - Hazard occurs more than 50 locations.
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to fall hazard or working from a ladder
Duration:	D = 1.3 Medium - Worker(s) at the location from 1 to 8 man-hours per occurrence, on average
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 5.95	
Probability:	5.0 and greater High - There is a high degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Extreme - > 30 ft: Extremely likely to cause permanent disability, or death

Notes: One half of the roof has a fall hazard height of 40' and the other half of the roof has a fall hazard height that varies between 9' and 20'.

Hazard Description

Risk Rating Level High Risk Hazard

Task: Roof Three has the following tasks: change the HVAC filters, maintain HVAC units, clean drains, change fan belts, and remove organic debris from roof. The roof itself also requires maintenance and repair on a sporadic basis.

Hazard: Workers are exposed to the roof edge (9' to 40' fall hazard) while performing maintenance, accessing equipment and cleaning roof drains.

Current Approach: Where possible workers maintain a minimum 10' distance from the roof edge. This is not always possible depending on the task.

Hazard Abatement

Conceptual Solution 1: Guardrails: Design and install guardrails to protect workers from a fall over the currently unprotected edges. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the roof will allow workers to access their work area without being exposed to a fall hazard.

Conceptual Solution 2: Designated Area and Restraint Horizontal Lifeline (HLL): Install warning lines at meeting OSHA's requirement 15 ft back from the building's unprotected edge. Develop a work procedure which documents the area inside these warning lines as a Designated Area. OSHA does not require workers to use fall protection when working from or accessing a designated area. This would be combined by an engineered and installed fall restraint HLL to protect workers when working outside of the designated area.

Conceptual Solution 3: Engineered Fall Restraint HLL: Engineer and install a fall restraint HLL to protect workers who are accessing and working on the entire area of the roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach to this system with a vertical lifeline (VLL) with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and they are restrained from accessing any of the fall hazards.

Location	Five Oaks Middle School: Roof Four
Slope of Roof	Flat < 2:12
Roof Surface	Standing Seam
Method of Access	Portable Ladder
Roof Access Area	Portable External Ladder
Fall Hazards	Skylights, Edges
Edge Height (ft)	19
Skylight Height (ft)	19

Hazard Survey

Location Five Oaks Elementary School

Area Roof Four: Access



Roof Four: Access

Relative Risk Rating: 15.12	
Frequency:	F = 1.3 Quarterly - Worker(s) at the location 3-5 /yr; quarterly maintenance, "as needed" work
Occurrence:	O = 1.1 Unique - Hazard occurs at only one location
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to a fall hazard or working from a ladder
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.3 Vertical - Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 3.78	
Probability:	3.1 - 4.0 Low - There is a low degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Notes: OSHA does not require workers use fall protection when properly climbing on portable ladders.

Hazard Description

Risk Rating Level Medium Risk Hazard

Task: Workers access the roof with a portable ladder as a fixed ladder is not available for roof access. Roof Four has the following tasks: remove organic debris, balls, and perform as needed roof repairs and inspections.

Hazard: Workers are exposed to a maximum fall of 19' when climbing on the ladder.

Current Approach: Workers are not required to use fall protection when accessing the roofs with a portable ladder. Methods to secure the top and bottom of the ladders are not used at these locations.

Hazard Abatement

Conceptual Solution 1: Written Portable Ladder Fall Protection Plan: Develop and implement a work procedure for using portable ladders. This plan shall satisfy OSHA requirements for climbing portable ladders such as: verifying ladder is OSHA compliant, correct ladder set up, and proper use when climbing the ladder (maintain three points of contact etc.), procedure for moving equipment onto the roof.

Conceptual Solution 2: Install Device to Secure the Ladder: Purchase and install a device to secure the top of the ladder to the existing structure when the ladder is in use. There are a number of different types of off the shelf devices (ladder top bracket types

and hook type devices) that will accomplish this. Install the device at this location to the manufacturer's specifications.

Conceptual Solution 3: Install Fixed Ladder with Self-Closing Swing Gate: Install fixed ladders, containing a self-closing safety gate, meeting OSHA's dimensional requirements. FS Industries (<http://www.fsindustries.com>) sells OSHA compliant fixed ladders ranging from 3' to 29' in height. Even though this option is not required by OSHA, Gravitec believes installing a fixed ladder will eliminate any chance of the ladder slipping or being set up improperly.

Hazard Survey

Location Five Oaks Middle School

Area Roof Four: Edge



Roof Four: Edge

Relative Risk Rating: 14.04	
Frequency:	F = 1.3 Quarterly - Worker(s) at the location 3-5 /yr; quarterly maintenance, "as needed" work
Occurrence:	O = 1.3 Common - Hazard occurs at 3 - 10 locations.
Proximity:	X = 1.2 Close - Worker(s) from 3 to 6 feet of a fall hazard
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.3 Extreme - Continuously slippery, steep, extremely difficult or uncomfortable to navigate
Probability Score 3.51	
Probability:	3.1 - 4.0 Low - There is a low degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Notes: This roof contains gutters. See report introduction for conclusion and recommended work procedures.

Hazard Description

Risk Rating Level	Medium Risk Hazard
Task:	Roof Four is only accessed to fix leaks, clean gutters and retrieve off trajectory balls from the roof.
Hazard:	Due to the low slope in the roof, balls roll to the edge of the roof. This means the workers are spending the majority of their time at the edge of the roof and exposed to a 19' fall hazard.
Current Approach:	The workers generally avoid accessing the roof. Or use a pole to push the balls off the roof while standing 10' away from the roof edge.

Hazard Abatement

Conceptual Solution 1:	Pole and Guardrail System: Gravitec suggests removing the need to access the roof edge to retrieve balls by using a telescopic pole with a rescue hook. This should be combined with verifying the load capacity of the roof to determine the roof's load bearing capacity, and its ability to hold counter weighted guardrail. Design and install guardrail sections to protect workers from a fall over the edge of the roof. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at this location will allow workers to access their work area, without being exposed to a fall hazard.
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Conceptual Solution 2: Pole and HLL: Gravitec suggests removing the need to access the roof edge to retrieve balls by using a telescopic pole with a rescue hook. This should be combined with designing and installing an engineered fall restraint HLL to protect workers while accessing and working on the entire roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach to this system with a VLL with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and are restrained from accessing any of the fall hazards.

Hazard Survey

Location Five Oaks Middle School

Area Roof Four: Floor Cover



Roof Four: Floor Cover

Relative Risk Rating:	17.45
Frequency:	F = 1.3 Quarterly - Worker(s) at the location 3-5 /yr; quarterly maintenance, "as needed" work
Occurrence:	O = 1.4 Very Common - Hazard occurs at 11 - 50 locations.
Proximity:	X = 1.2 Close - Worker(s) from 3 to 6 feet of a fall hazard
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score	3.49
Probability:	3.1 - 4.0 Low - There is a low degree of possibility that a fall accident may occur at this hazard
Protection:	1.25 Dangerous - Existing System Increases Fall Hazard
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Hazard Description

Risk Rating Level	Medium Risk Hazard
Task:	Roof Four is only accessed to fix leaks, and retrieve off trajectory balls from the roof.
Hazard:	The roof has 12 fiberglass panels used to let light through to covered play area. Gravitec observed significant deflection in these panels with a limited amount of force placed on them. Gravitec does not believe these panels are rated to, or will, support the weight of a worker. The fall distance through these panels to the ground is 19'.
Current Approach:	Currently workers try and avoid walking near the panels.

Hazard Abatement

Conceptual Solution 1:	Verify Panel Load Rating: Verify if the panels are strong enough to meet OSHA's floor cover requirement.
Conceptual Solution 2:	Skylight Covers - design and fabricate or purchase off the shelf skylight covers. Ensure the purchased or designed skylight covers meet OSHA strength and dimensions requirements for covers used to mitigate floor holes and wall gaps. Installing skylight covers at this location will protect workers when walking or working by the skylights.
Conceptual Solution 3:	Guardrails: Design and install guardrails to protect workers from a fall through the currently unprotected panels. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the panels will allow workers to access their work area without being exposed to a fall hazard.

Location	Five Oaks Middle School: Roof Five
Slope of Roof	Flat < 2:12
Roof Surface	EPDM
Method of Access	Portable Ladder
Roof Access Area	Portable External Ladder
Fall Hazards	Edges
Edge Height (ft)	7

Hazard Survey

Location Five Oaks Middle School

Area Roof Five: Roof Access



Roof Five: Roof Access

Relative Risk Rating: 10.30	
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.3 Common - Hazard occurs at 3 - 10 locations.
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to a fall hazard or working from a ladder
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.3 Vertical - Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 5.15	
Probability:	5.0 and greater High - There is a high degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Moderate - >4 to 10ft: Likely to cause moderate injury requiring first aid or medical attention

Hazard Description

Risk Rating Level	Low Risk Hazard
Task:	Roof Five is only accessed to fix leaks, and clean roof drains. Workers access these roofs with a portable ladder as a fixed ladder is not installed for these roofs.
Hazard:	Workers are exposed to 7' fall hazard when climbing the portable ladder.
Current Approach:	Workers are not required to use fall protection when accessing the roofs with a portable ladder. Methods to secure the top and bottom of the ladders are not used at these locations.

Hazard Abatement

Conceptual Solution 1:	Install Fixed Ladder with Self-Closing Swing Gate: Install fixed ladder containing a self-closing safety gate, meeting OSHA's dimensional requirements. FS Industries (http://www.fsindustries.com) sells OSHA compliant fixed ladders ranging from 3' to 29' in height. Even though this option is not required by OSHA, Gravite believes installing a fixed ladder will eliminate any chance of the ladder slipping or being set up improperly.
Conceptual Solution 2:	Install Device to Secure the Ladder: Purchase and install a device to secure the top of the ladder to the existing structure when the ladder is in use. There are a number of different types of off the shelf devices (ladder top bracket types and hook type devices) that will accomplish this. Install the device at this location to the manufacturer's specifications.

Conceptual Solution 3: Written Portable Ladder Fall Protection Plan: Develop and implement a work procedure for using portable ladders. This plan shall satisfy OSHA requirements for climbing portable ladders such as: verifying ladder is OSHA compliant, correct ladder set up, and proper use when climbing the ladder (maintain three points of contact ect.), procedure for moving equipment onto the roof.

Hazard Survey

Location Five Oaks Middle School

Area Roof Five: Edge



Roof Five: Edge

Relative Risk Rating:	10.98
Frequency:	F = 1.5 Weekly - Worker(s) at the location 13-52 /yr; weekly maintenance, "as needed" work
Occurrence:	O = 1.5 Recurring - Hazard occurs more than 50 locations.
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to fall hazard or working from a ladder
Duration:	D = 1.2 Short - Worker(s) at the location from 0.1 to 1.0 man-hours per occurrence, on average
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.1 Fair - Not designed for walk & work or outdoor / worker can still navigate relatively easily
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score	5.49
Probability:	5.0 and greater High - There is a high degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Moderate - >4 to 10ft: Likely to cause moderate injury requiring first aid or medical attention

Hazard Description

Risk Rating Level	Medium Risk Hazard
Task:	Workers are in this location to clean roof drains, remove organic debris and performing as needed roof repairs and inspections.
Hazard:	While walking and working on the roof workers are exposed to an 7' fall to the lower roof level. OSHA requires workers to use fall protection when working next to an exposed edge having a fall height greater than 4'.
Current Approach:	No fall protection is currently available for workers on this roof. Workers try to stay 10' from the edge of the roof. All of the roof drains are located directly by the roof edge.

Hazard Abatement

Conceptual Solution 1:	Guardrail and Swing Gate: Design and install guardrails to protect workers from a fall over the currently unprotected edges. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the roof will allow workers to access their work area without being exposed to a fall hazard. Incorporate a self closing swing gate into this system to allow workers easy access when transitioning between the ladder and the roof.
Conceptual Solution 2:	Engineered Fall Restraint HLL: Engineer and install a fall restraint HLL to protect workers who are accessing and working on the entire area of the roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach to this system with a vertical lifeline (VLL) with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and they are restrained from accessing any of the fall hazards. The minimum height of these roofs does not have enough fall clearance to allow for a fall arrest system.

Location	Five Oaks Middle School: Roof Six
Slope of Roof	Flat < 2:12
Roof Surface	EPDM
Method of Access	Portable Ladder
Roof Access Area	Portable External Ladder
Fall Hazards	Edges
Edge Height (ft)	19

Hazard Survey

Location Five Oaks Middle School

Area Roof Six: Roof Access



Roof Six: Roof Access

Relative Risk Rating: 15.12	
Frequency:	F = 1.3 Quarterly - Worker(s) at the location 3-5 /yr; quarterly maintenance, "as needed" work
Occurrence:	O = 1.1 Unique - Hazard occurs at only one location
Proximity:	X = 1.4 Immediate - Worker(s) directly exposed to a fall hazard or working from a ladder
Duration:	D = 1.1 Brief - Worker(s) at the location for less than 6 man-minutes (0.1 man-hour) per occurrence
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.3 Vertical - Vertical ladder, rebar, bosun chair, hoist, rope access, temp. staging, or similar
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 3.78	
Probability:	3.1 - 4.0 Low - There is a low degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Hazard Description

Risk Rating Level	Medium Risk Hazard
Task:	Roof Six is only accessed to fix leaks, and clean roof drains, and remove balls. Workers access these roofs with a portable ladder as a fixed ladder is not installed on these roofs.
Hazard:	Workers are exposed to 19' fall hazard when climbing the fixed ladder.
Current Approach:	Workers are not required to use fall protection when accessing the roofs with a portable ladder. Fall protection is not available at the locations. Methods to secure the top and bottom of the ladders are not used at these locations.

Hazard Abatement

Conceptual Solution 1:	Install Fixed Ladder with Self-Closing Swing Gate: Install fixed ladders containing a self-closing safety gate, meeting OSHA's dimensional requirements. FS Industries (http://www.fsindustries.com) sells OSHA compliant fixed ladders ranging from 3' to 29' in height. Even though this option is not required by OSHA, Gravitec believes installing a fixed ladder will eliminate any chance of the ladder slipping or being set up.
Conceptual Solution 2:	Install Device to Secure the Ladder: Purchase and install a device to secure the top of the ladder to the existing structure when the ladder is in use. There are a number of different types of off the shelf devices (ladder top bracket types and hook type devices) that will accomplish this. Install the device at this location to the manufacturer's specifications.
Conceptual Solution 3:	Written Portable Ladder Fall Protection Plan: Develop and implement a work procedure for using portable ladders. This plan shall satisfy OSHA

requirements for climbing portable ladders such as: verifying ladder is OSHA compliant, correct ladder set up, and proper use when climbing the ladder (maintain three points of contact ect.), procedure for moving equipment onto the roof.

Hazard Survey

Location

Five Oaks Middle School

Area

Roof Six: Edge



Roof Six: Edge

Relative Risk Rating: 12.84	
Frequency:	F = 1.3 Quarterly - Worker(s) at the location 3-5 /yr; quarterly maintenance, "as needed" work
Occurrence:	O = 1.3 Common - Hazard occurs at 3 - 10 locations.
Proximity:	X = 1.2 Close - Worker(s) from 3 to 6 feet of a fall hazard
Duration:	D = 1.2 Short - Worker(s) at the location from 0.1 to 1.0 man-hours per occurrence, on average
Interference:	I = 1.1 Independent - All workers are separated or there is only one worker
Security:	C = 1.0 Excellent - Solid, flat, secure & stable, designed and engineered walking/working surface
Environment:	E = 1.2 Variable - Uncontrolled variables or weather may compromise worker comfort & stability
Probability Score 3.21	
Probability:	3.1 - 4.0 Low - There is a low degree of possibility that a fall accident may occur at this hazard
Protection:	1.0 None - No fall protection or system is life threatening
Severity:	Critical - >16 to 30 ft: Likely to cause critical injury, permanent or temporary disability, or death

Hazard Description

Risk Rating Level	Medium Risk Hazard
Task:	Workers are in this location to clean roof drains, remove organic debris and when performing as needed roof repairs and inspections.
Hazard:	Workers are exposed to the roof edge (19' fall hazard) while performing maintenance, accessing equipment and cleaning roof drains.
Current Approach:	Where possible workers maintain a minimum 10' distance from the roof edge. This is not always possible depending on the task.

Hazard Abatement

Conceptual Solution 1:	Guardrails: Design and install guardrails to protect workers from a fall over the currently unprotected edges. Ensure the guardrails are designed to satisfy OSHA's dimensional and strength requirements. Installing guardrails at the perimeter of the roof will allow workers to access their work area without being exposed to a fall hazard.
Conceptual Solution 2:	Designated Area and Restraint Horizontal Lifeline (HLL): Install warning lines at meeting OSHA's requirement 15 ft back from the building's unprotected edge. Develop a work procedure which documents the area inside these warning lines as a Designated Area. OSHA does not require workers to use fall protection when working from or accessing a designated area. This would be combined by an engineered and installed fall restraint HLL to protect workers when working outside of the designated area.
Conceptual Solution 3:	Engineered Fall Restraint HLL: Engineer and install a fall restraint HLL to protect workers who are accessing and working on the entire area of the roof. Design this system for fall arrest loading per ANSI Z359.6. Workers shall attach

to this system with a vertical lifeline (VLL) with an adjustable rope grab. Workers shall adjust the rope grab as needed to ensure they can access all required work areas, and they are restrained from accessing any of the fall hazards.

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MEADOW PARK	6	Edge	RT	41.00	Guardrail	Horizontal Lifeline	
TIMBERLAND	1	Edge	RT	40.56	Intermittent Guardrail		
TIMBERLAND	4	Edge	RT	40.56	Intermittent Guardrail		
TIMBERLAND	5	Edge	RT	40.56	Gutter Guards	Guardrail	Horizontal Lifeline
MEADOW PARK	6	Skylight	RT	32.19	Skylight Covers	Horizontal Lifeline	
CEDAR PARK	6	Edge	BG	31.56	Intermittent Guardrail	Horizontal Lifeline	
FIVE OAKS	3	Edge	BG	29.75	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	6	Skylight	BG	27.63	Skylight Covers	Horizontal Lifeline	
CONESTOGA	8	Edge	KRV	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	1	Edge	BG	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	7	Edge	AM	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
TIMBERLAND	3	Edge	RT	27.45	Guardrail		
TIMBERLAND	7	Edge	RT	27.45	Intermittent Guardrail		
MEADOW PARK	4	Edge	RT	27.45	Guardrail	Horizontal Lifeline	
TIMBERLAND	6	Access	RT	27.25	No Action Required		
MEADOW PARK	7	Edge	RT	26.24	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
CEDAR PARK	8	Edge	BG	25.60	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	5	Edge	RT	25.60	Intermittent Guardrail	Horizontal Lifeline	
MEADOW PARK	8	Edge	RT	25.60	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	4	Edge	BG	23.80	Guardrail	Horizontal Lifeline	
MOUNTAIN VIEW	1	Edge	RT	23.80	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MOUNTAIN VIEW	3	Edge	RT	23.80	Guardrail	Horizontal Lifeline	
MOUNTAIN VIEW	5	Edge	RT	23.80	Guardrail	Horizontal Lifeline	Resolve Standing Water
MOUNTAIN VIEW	3	Access Hatch	RT	23.60	Verify Ladder Use	Replace Ladder	

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
HIGHLAND PARK	7	Skylight	AM	22.10	Skylight Covers	Horizontal Lifeline	Guardrails
CONESTOGA	4	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	5	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	6	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	7	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	9	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	11	Edge	KRV	21.96	Guardrail	Horizontal Lifeline	
CONESTOGA	15	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	2	Edge	BG	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	3	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	4	Edge	AM	21.96	Install Fixed Ladder With Swing Gate	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	5	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	6	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
TIMBERLAND	2	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
TIMBERLAND	6	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
TIMBERLAND	8	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
WHITFORD	5	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	5	Edge	BG	21.95	Intermittent Guardrail	Horizontal Lifeline	
CEDAR PARK	7	Skylight	BG	21.80	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
MEADOW PARK	7	Skylight	RT	20.60	Telescopic Pole and Skylight Covers	Telescopic Pole and Horizontal Lifeline	
CEDAR PARK	7	Edge	BG	20.48	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
WHITFORD	1	Edge	KRV	20.48	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	2	Edge	KRV	20.48	Guardrail		
WHITFORD	4	Edge	KRV	20.48	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MOUNTAIN VIEW	4	Skylight	RT	19.41	Skylight Covers	Horizontal Lifeline	
MOUNTAIN VIEW	4	Edge	RT	19.20	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	9	Windows	KRV	19.04	Verify Load Rating on Glass		
WHITFORD	5	Skylight	KRV	19.04	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	1	Edge	BG	18.75	Verify Panel Load Rating	Guardrail	Horizontal Lifeline
WHITFORD	3	Edge	KRV	17.97	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	1	Edge	BG	17.85	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	1	Edge	AM	17.85	Guardrail and Tree Pruner	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	1	Edge	RT	17.85	Guardrail, Tree Pruners, Gutter Guards	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	4	Skylight	KRV	17.56	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	4	Skylight	BG	17.45	Verify Panel Load Rating	Skylight Covers	Guardrails
CEDAR PARK	5	Access	BG	17.44	Replace Ladder	Davit Arm	
CEDAR PARK	7	Access	BG	17.44	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
CONESTOGA	4	Access	KRV	17.44	Swing Gate	Davit Arm	
CONESTOGA	8	Access	KRV	17.44	Swing Gate	Modify Ladder	
CONESTOGA	10	Access	KRV	17.44	Swing Gate	Davit Arm	
FIVE OAKS	3	Access	BG	17.44	Swing Gate	Replace Ladder	
MEADOW PARK	6	Access	RT	17.44	Swing Gate, Add Grip Tape		
STOLLER	4	Access	BG	17.44	Swing Gate		
STOLLER	4	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	5	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	6	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	1	Skylight	RT	16.65	Skylight Covers, Tree Pruners, Gutter Guards	Horizontal Lifeline	
CONESTOGA	1	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
CONESTOGA	2	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	3	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	12	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	2	Edge	AM	16.47	Guardrail and Tree Pruner	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	5	Skylight	AM	16.32	Skylight Covers	Guardrail	
CONESTOGA	14	Skylight	KRV	16.08	Skylight Covers	Guardrail	Horizontal Lifeline
TIMBERLAND	1	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	3	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	4	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	7	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
HIGHLAND PARK	1	Skylight	AM	15.45	Skylight Covers	Horizontal Lifeline	Guardrails
CEDAR PARK	1	Skylight	BG	15.36	Skylight Covers	Horizontal Lifeline	
CONESTOGA	4	Windows	KRV	15.36	Verify Load Rating of Glass		
MEADOW PARK	3	Edge	RT	15.36	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	3	Skylight	KRV	15.36	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	4	Access	BG	15.12	Ensure Portable Ladder Fall Protection Plan	Install Ladder Ports	Fix Ladder
FIVE OAKS	6	Access	BG	15.12	Install Fixed Ladder With Swing Gate	Install Ladder Ports	Ensure Portable Ladder Fall Protection Plan
CONESTOGA	1	Windows	KRV	14.28	Verify Load Rating on Glass		
CONESTOGA	2	Windows	KRV	14.28	Verify Load Rating of Glass		
CONESTOGA	3	Windows	KRV	14.28	Verify Load Rating of Glass		
CONESTOGA	13	Windows	KRV	14.28	Verify Load Rating of Glass		
CONESTOGA	14	Edge	KRV	14.28	Guardrail	Horizontal Lifeline	
FIVE OAKS	4	Edge	BG	14.04	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
STOLLER	5	Access	BG	13.96	Swing Gate		

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
CEDAR PARK	1	Access	BG	13.08	Replace Ladder	Davit Arm	
CEDAR PARK	3	Edge	BG	13.08	Guardrail	Designated Area with Horizontal Lifeline	
CEDAR PARK	6	Access	BG	13.08	Replace Ladder	Davit Arm	
CONESTOGA	1	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	2	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	3	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	6	Access	KRV	13.08	Swing Gate with Guardrail	Install New Ladder	
CONESTOGA	7	Access	KRV	13.08	Swing Gate	Modify Ladder	
CONESTOGA	9	Access	KRV	13.08	Swing Gate	Modify Ladder	
CONESTOGA	14	Access	KRV	13.08	Swing Gate		
FIVE OAKS	2	Access	BG	13.08	Swing Gate	Extended Guardrail	Davit Arm
HIGHLAND PARK	3	Access Ladder	AM	13.08	Replace Ladder. Add Grip Tape	Davit Arm	
HIGHLAND PARK	4	Access	AM	13.08	No Action Required	Davit Arm	
HIGHLAND PARK	7	Access	AM	13.08	Replace Ladder		
MEADOW PARK	1	Access	RT	13.08	Swing Gate, Add Grip Tape	Davit Arm	
MEADOW PARK	7	Access	RT	13.08	Swing Gate		
MOUNTAIN VIEW	1	Access	RT	13.08	Swing Gate	Davit Arm	
MOUNTAIN VIEW	2	Edge	RT	13.08	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
MOUNTAIN VIEW	3	Access	RT	13.08	Swing Gate	Davit Arm	
MOUNTAIN VIEW	4	Access	RT	13.08	Swing Gate	Davit Arm	
STOLLER	1	Access	BG	13.08	Swing Gate	Modify Hatch	Davit Arm
WHITFORD	5	Access	KRV	13.08	Swing Gate	Modify Ladder	
MEADOW PARK	4	HAVAC	RT	12.88	Remove Ladder	Install Ladder with Swing Gate, Add Grip Tape	
FIVE OAKS	6	Edge	BG	12.84	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
HIGHLAND PARK	6	Skylight	AM	12.64	Skylight Covers	Horizontal Lifeline	Guardrails
MOUNTAIN VIEW	2	HVAC	RT	12.21	Telescopic Pole and Skylight Covers	Telescopic Pole and Horizontal Lifeline	
STOLLER	1	Skylight	BG	12.15	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	6	Edge	KRV	12.06	Guardrail	Horizontal Lifeline	
STOLLER	3	Skylight	BG	11.96	Verify Skylight Load Rating	Guardrail	Horizontal Lifeline
STOLLER	5	Skylights	BG	11.96	Verify Skylight Load Rating	Guardrail	Horizontal Lifeline
STOLLER	6	Skylights	BG	11.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	2	Access	RT	11.80	Verify Use of Hatch	Move Light Situated over Hatch	
STOLLER	3	Edge	BG	11.76	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	2	Edge	BG	11.35	Guardrail	Horizontal Lifeline	
CEDAR PARK	8	Skylight	BG	11.22	Skylight Covers	Horizontal Lifeline	
CEDAR PARK	2	Access	BG	10.90	Verify Hatch Usage	Move Light	
MEADOW PARK	4	Access	RT	10.90	Swing Gate	Davit Arm	
HIGHLAND PARK	1	Access	AM	10.89	Replace Ladder	Install Davit Arm	
STOLLER	2	Lower Edge	BG	10.88	Guardrail	Horizontal Lifeline	
CONESTOGA	4	HVAC	KRV	10.62	Verify Service Method		
FIVE OAKS	5	Access	BG	10.30	Ensure Portable Ladder Fall Protection Plan	Install Ladder Ports	Fix Ladder
CONESTOGA	13	HVAC	KRV	9.82	Portable Davit Arm		
TIMBERLAND	1	Access	RT	9.81	Swing Gate	Davit Arm	
TIMBERLAND	4	Access	RT	9.81	Swing Gate	Davit Arm	
MOUNTAIN VIEW	4	HVAC	RT	9.62	Portable Davit Arm	Skylight Covers	
MOUNTAIN VIEW	2	Access	RT	9.60	Replace Ladder		
CONESTOGA	1	HVAC	KRV	9.00	Portable Davit Arm		
CONESTOGA	2	HVAC	KRV	9.00	Portable Davit Arm		

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
CONESTOGA	3	HVAC	KRV	9.00	Portable Davit Arm		
MOUNTAIN VIEW	1	HVAC	RT	8.94	Portable Davit Arm	Skylight Covers	
CEDAR PARK	3	Access	BG	8.72	Install Ladder		
CEDAR PARK	4	Access	BG	8.72	Modify Hatch and Ladder	Swing Gate	Davit Arm
CEDAR PARK	8	Access	BG	8.72	Swing Gate	Replace Ladder and Hatch	Davit Arm
CONESTOGA	5	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	7	Access Ladder	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	8	Access Ladder	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	11	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	12	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	13	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	15	Access	KRV	8.72	Swing Gate	Modify Ladder	
HIGHLAND PARK	5	Access	AM	8.72	Replace Ladder, Add Swing Gate, Add Grip Tape		
STOLLER	2	Access	BG	8.72	Replace Ladder		
STOLLER	3	Access	BG	8.72	Install Step		
WHITFORD	1	Access	KRV	8.72	Swing Gate	Modify Ladder	
WHITFORD	2	Access	KRV	8.72	Swing Gate	Modify Ladder	
WHITFORD	3	Access	KRV	8.72	Swing Gate	Grip Tape	Davit Arm
WHITFORD	4	Access	KRV	8.72	Swing Gate		
STOLLER	2	Lower Access	BG	7.56	Replace Ladder		
STOLLER	3	Elevation Change	BG	7.56	Install Step		
HIGHLAND PARK	1	HVAC	AM	6.98	Portable Davit Arm		
FIVE OAKS	5	Edge	BG	6.96	Guardrail	Horizontal Lifeline	
MEADOW PARK	1	HVAC	RT	6.92	Portable Davit Arm		

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MEADOW PARK	8	Skylight	RT	6.86	Skylight Covers	Horizontal Lifeline	
MOUNTAIN VIEW	3	HVAC	RT	6.71	Portable Davit Arm		
HIGHLAND PARK	3	Access	AM	6.70	Verify Access Requirements	Davit Arm	
MEADOW PARK	5	Access	RT	6.54	Swing Gate, Add Grip Tape		
MEADOW PARK	8	Access	RT	6.54	Swing Gate	Davit Arm	
MOUNTAIN VIEW	5	HVAC	RT	5.67	Portable Davit Arm		
CONESTOGA	1	Elevation Change	KRV	4.36	No Action Required		
CONESTOGA	2	Elevation Change	KRV	4.36	No Action Required		
CONESTOGA	3	Elevation Change	KRV	4.36	No Action Required		
CONESTOGA	7	Access Ladder	KRV	4.36	Swing Gate	Modify Ladder	
HIGHLAND PARK	2	Access	AM	4.36	Replace Ladder		
STOLLER	6	Access	BG	4.36	Install Ladder		
TIMBERLAND	5	Access	RT	3.27	No Action Required		
MEADOW PARK	3	Access	RT	3.27	Install Step		
CEDAR PARK	1	Elevation Change	BG	3.01	Install Step		
MEADOW PARK	1	Elevation Change	RT	3.01	Install Step		
TIMBERLAND	3	Access	RT	2.38	No Action Required		
TIMBERLAND	2	Access	RT	2.18	No Action Required		
TIMBERLAND	7	Access	RT	2.18	No Action Required		
TIMBERLAND	8	Access	RT	2.18	No Action Required		
HIGHLAND PARK	6	Access	AM	1.81	Modify Hatch, Add Swing Gate		
CONESTOGA	10	Edge	KRV	1.65	No Action Required		
CONESTOGA	13	Edge	KRV	1.10	No Action Required		
FIVE OAKS	1	Access	BG	1.10	Modify Guardrail		

6.1 Hazard Summary - All Middle Schools

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MOUNTAIN VIEW	5	Access	RT	1.01	Extend Guardrail		

6.1.1 Hazard Summary - Access

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
TIMBERLAND	6	Access	RT	27.25	No Action Required		
MOUNTAIN VIEW	3	Access Hatch	RT	23.60	Verify Ladder Use	Replace Ladder	
CEDAR PARK	5	Access	BG	17.44	Replace Ladder	Davit Arm	
CEDAR PARK	7	Access	BG	17.44	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
CONESTOGA	4	Access	KRV	17.44	Swing Gate	Davit Arm	
CONESTOGA	8	Access	KRV	17.44	Swing Gate	Modify Ladder	
CONESTOGA	10	Access	KRV	17.44	Swing Gate	Davit Arm	
FIVE OAKS	3	Access	BG	17.44	Swing Gate	Replace Ladder	
MEADOW PARK	6	Access	RT	17.44	Swing Gate, Add Grip Tape		
STOLLER	4	Access	BG	17.44	Swing Gate		
FIVE OAKS	4	Access	BG	15.12	Ensure Portable Ladder Fall Protection Plan	Install Ladder Ports	Fix Ladder
FIVE OAKS	6	Access	BG	15.12	Install Fixed Ladder With Swing Gate	Install Ladder Ports	Ensure Portable Ladder Fall Protection Plan
STOLLER	5	Access	BG	13.96	Swing Gate		
CEDAR PARK	1	Access	BG	13.08	Replace Ladder	Davit Arm	
CEDAR PARK	6	Access	BG	13.08	Replace Ladder	Davit Arm	
CONESTOGA	1	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	2	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	3	Access	KRV	13.08	Swing Gate	Davit Arm	
CONESTOGA	6	Access	KRV	13.08	Swing Gate with Guardrail	Install New Ladder	
CONESTOGA	7	Access	KRV	13.08	Swing Gate	Modify Ladder	
CONESTOGA	9	Access	KRV	13.08	Swing Gate	Modify Ladder	
CONESTOGA	14	Access	KRV	13.08	Swing Gate		
FIVE OAKS	2	Access	BG	13.08	Swing Gate	Extended Guardrail	Davit Arm
HIGHLAND PARK	4	Access	AM	13.08	No Action Required	Davit Arm	

6.1.1 Hazard Summary - Access

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
HIGHLAND PARK	7	Access	AM	13.08	Replace Ladder		
MEADOW PARK	1	Access	RT	13.08	Swing Gate, Add Grip Tape	Davit Arm	
MEADOW PARK	7	Access	RT	13.08	Swing Gate		
MOUNTAIN VIEW	1	Access	RT	13.08	Swing Gate	Davit Arm	
MOUNTAIN VIEW	3	Access	RT	13.08	Swing Gate	Davit Arm	
MOUNTAIN VIEW	4	Access	RT	13.08	Swing Gate	Davit Arm	
STOLLER	1	Access	BG	13.08	Swing Gate	Modify Hatch	Davit Arm
WHITFORD	5	Access	KRV	13.08	Swing Gate	Modify Ladder	
HIGHLAND PARK	3	Access Ladder	AM	13.08	Replace Ladder. Add Grip Tape	Davit Arm	
MEADOW PARK	2	Access	RT	11.80	Verify Use of Hatch	Move Light Situated over Hatch	
CEDAR PARK	2	Access	BG	10.90	Verify Hatch Usage	Move Light	
MEADOW PARK	4	Access	RT	10.90	Swing Gate	Davit Arm	
HIGHLAND PARK	1	Access	AM	10.89	Replace Ladder	Install Davit Arm	
FIVE OAKS	5	Access	BG	10.30	Ensure Portable Ladder Fall Protection Plan	Install Ladder Ports	Fix Ladder
TIMBERLAND	1	Access	RT	9.81	Swing Gate	Davit Arm	
TIMBERLAND	4	Access	RT	9.81	Swing Gate	Davit Arm	
MOUNTAIN VIEW	2	Access	RT	9.60	Replace Ladder		
CEDAR PARK	3	Access	BG	8.72	Install Ladder		
CEDAR PARK	4	Access	BG	8.72	Modify Hatch and Ladder	Swing Gate	Davit Arm
CONESTOGA	5	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	11	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	12	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	13	Access	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	15	Access	KRV	8.72	Swing Gate	Modify Ladder	

6.1.1 Hazard Summary - Access

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
HIGHLAND PARK	5	Access	AM	8.72	Replace Ladder, Add Swing Gate, Add Grip Tape		
STOLLER	2	Access	BG	8.72	Replace Ladder		
STOLLER	3	Access	BG	8.72	Install Step		
WHITFORD	1	Access	KRV	8.72	Swing Gate	Modify Ladder	
WHITFORD	2	Access	KRV	8.72	Swing Gate	Modify Ladder	
WHITFORD	3	Access	KRV	8.72	Swing Gate	Grip Tape	Davit Arm
WHITFORD	4	Access	KRV	8.72	Swing Gate		
CEDAR PARK	8	Access	BG	8.72	Swing Gate	Replace Ladder and Hatch	Davit Arm
CONESTOGA	7	Access Ladder	KRV	8.72	Swing Gate	Modify Ladder	
CONESTOGA	8	Access Ladder	KRV	8.72	Swing Gate	Modify Ladder	
HIGHLAND PARK	3	Access	AM	6.70	Verify Access Requirements	Davit Arm	
MEADOW PARK	5	Access	RT	6.54	Swing Gate, Add Grip Tape		
MEADOW PARK	8	Access	RT	6.54	Swing Gate	Davit Arm	
HIGHLAND PARK	2	Access	AM	4.36	Replace Ladder		
STOLLER	6	Access	BG	4.36	Install Ladder		
CONESTOGA	7	Access Ladder	KRV	4.36	Swing Gate	Modify Ladder	
TIMBERLAND	5	Access	RT	3.27	No Action Required		
MEADOW PARK	3	Access	RT	3.27	Install Step		
TIMBERLAND	3	Access	RT	2.38	No Action Required		
TIMBERLAND	2	Access	RT	2.18	No Action Required		
TIMBERLAND	7	Access	RT	2.18	No Action Required		
TIMBERLAND	8	Access	RT	2.18	No Action Required		
HIGHLAND PARK	6	Access	AM	1.81	Modify Hatch, Add Swing Gate		
FIVE OAKS	1	Access	BG	1.10	Modify Guardrail		

6.1.1 Hazard Summary - Access

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MOUNTAIN VIEW	5	Access	RT	1.01	Extend Guardrail		

6.1.2 Hazard Summary - Edge

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MEADOW PARK	6	Edge	RT	41.00	Guardrail	Horizontal Lifeline	
TIMBERLAND	1	Edge	RT	40.56	Intermittent Guardrail		
TIMBERLAND	4	Edge	RT	40.56	Intermittent Guardrail		
TIMBERLAND	5	Edge	RT	40.56	Gutter Guards	Guardrail	Horizontal Lifeline
CEDAR PARK	6	Edge	BG	31.56	Intermittent Guardrail	Horizontal Lifeline	
FIVE OAKS	3	Edge	BG	29.75	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	8	Edge	KRV	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	1	Edge	BG	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	7	Edge	AM	27.45	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
TIMBERLAND	3	Edge	RT	27.45	Guardrail		
TIMBERLAND	7	Edge	RT	27.45	Intermittent Guardrail		
MEADOW PARK	4	Edge	RT	27.45	Guardrail	Horizontal Lifeline	
MEADOW PARK	7	Edge	RT	26.24	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
CEDAR PARK	8	Edge	BG	25.60	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	5	Edge	RT	25.60	Intermittent Guardrail	Horizontal Lifeline	
MEADOW PARK	8	Edge	RT	25.60	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	4	Edge	BG	23.80	Guardrail	Horizontal Lifeline	
MOUNTAIN VIEW	1	Edge	RT	23.80	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MOUNTAIN VIEW	3	Edge	RT	23.80	Guardrail	Horizontal Lifeline	
MOUNTAIN VIEW	5	Edge	RT	23.80	Guardrail	Horizontal Lifeline	Resolve Standing Water
CONESTOGA	4	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	5	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	6	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	7	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline

6.1.2 Hazard Summary - Edge

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
CONESTOGA	9	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	11	Edge	KRV	21.96	Guardrail	Horizontal Lifeline	
CONESTOGA	15	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	2	Edge	BG	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	3	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	4	Edge	AM	21.96	Install Fixed Ladder With Swing Gate	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	5	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	6	Edge	AM	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
TIMBERLAND	2	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
TIMBERLAND	6	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
TIMBERLAND	8	Edge	RT	21.96	Gutter Guards	Guardrail	Horizontal Lifeline
WHITFORD	5	Edge	KRV	21.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	5	Edge	BG	21.95	Intermittent Guardrail	Horizontal Lifeline	
CEDAR PARK	7	Edge	BG	20.48	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
WHITFORD	1	Edge	KRV	20.48	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	2	Edge	KRV	20.48	Guardrail		
WHITFORD	4	Edge	KRV	20.48	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MOUNTAIN VIEW	4	Edge	RT	19.20	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	1	Edge	BG	18.75	Verify Panel Load Rating	Guardrail	Horizontal Lifeline
WHITFORD	3	Edge	KRV	17.97	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	1	Edge	BG	17.85	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	1	Edge	AM	17.85	Guardrail and Tree Pruner	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	1	Edge	RT	17.85	Guardrail, Tree Pruners, Gutter Guards	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	4	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline

6.1.2 Hazard Summary - Edge

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
STOLLER	5	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	6	Edge	BG	17.40	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	1	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	2	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	3	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	12	Edge	KRV	16.47	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
HIGHLAND PARK	2	Edge	AM	16.47	Guardrail and Tree Pruner	Designated Area with Horizontal Lifeline	Horizontal Lifeline
MEADOW PARK	3	Edge	RT	15.36	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CEDAR PARK	1	Skylight	BG	15.36	Skylight Covers	Horizontal Lifeline	
CONESTOGA	14	Edge	KRV	14.28	Guardrail	Horizontal Lifeline	
FIVE OAKS	4	Edge	BG	14.04	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
CEDAR PARK	3	Edge	BG	13.08	Guardrail	Designated Area with Horizontal Lifeline	
MOUNTAIN VIEW	2	Edge	RT	13.08	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
FIVE OAKS	6	Edge	BG	12.84	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	6	Edge	KRV	12.06	Guardrail	Horizontal Lifeline	
STOLLER	3	Edge	BG	11.76	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	2	Edge	BG	11.35	Guardrail	Horizontal Lifeline	
STOLLER	2	Lower Edge	BG	10.88	Guardrail	Horizontal Lifeline	
FIVE OAKS	5	Edge	BG	6.96	Guardrail	Horizontal Lifeline	
CONESTOGA	10	Edge	KRV	1.65	No Action Required		
CONESTOGA	13	Edge	KRV	1.10	No Action Required		

6.1.3 Hazard Summary - Other

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
MEADOW PARK	6	Skylight	RT	32.19	Skylight Covers	Horizontal Lifeline	
CEDAR PARK	6	Skylight	BG	27.63	Skylight Covers	Horizontal Lifeline	
HIGHLAND PARK	7	Skylight	AM	22.10	Skylight Covers	Horizontal Lifeline	Guardrails
CEDAR PARK	7	Skylight	BG	21.80	Telescopic Pole and Guardrail	Telescopic Pole and Horizontal Lifeline	
MEADOW PARK	7	Skylight	RT	20.60	Telescopic Pole and Skylight Covers	Telescopic Pole and Horizontal Lifeline	
MOUNTAIN VIEW	4	Skylight	RT	19.41	Skylight Covers	Horizontal Lifeline	
CONESTOGA	9	Windows	KRV	19.04	Verify Load Rating on Glass		
WHITFORD	5	Skylight	KRV	19.04	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
WHITFORD	4	Skylight	KRV	17.56	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
FIVE OAKS	4	Skylight	BG	17.45	Verify Panel Load Rating	Skylight Covers	Guardrails
MEADOW PARK	1	Skylight	RT	16.65	Skylight Covers, Tree Pruners, Gutter Guards	Horizontal Lifeline	
HIGHLAND PARK	5	Skylight	AM	16.32	Skylight Covers	Guardrail	
CONESTOGA	14	Skylight	KRV	16.08	Skylight Covers	Guardrail	Horizontal Lifeline
TIMBERLAND	7	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	1	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	3	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
TIMBERLAND	4	HVAC	RT	15.93	Portable Davit Arm	Gateway Rear Exit Ladder	
HIGHLAND PARK	1	Skylight	AM	15.45	Skylight Covers	Horizontal Lifeline	Guardrails
CONESTOGA	4	Windows	KRV	15.36	Verify Load Rating of Glass		
CEDAR PARK	1	Skylight	BG	15.36	Skylight Covers	Horizontal Lifeline	
WHITFORD	3	Skylight	KRV	15.36	Skylight Covers	Designated Area with Horizontal Lifeline	Horizontal Lifeline
CONESTOGA	1	Windows	KRV	14.28	Verify Load Rating on Glass		
CONESTOGA	2	Windows	KRV	14.28	Verify Load Rating of Glass		
CONESTOGA	3	Windows	KRV	14.28	Verify Load Rating of Glass		

6.1.3 Hazard Summary - Other

School	Roof Number	Hazard I.D.	Survey Written	Relative Risk Rating	Action One	Action Two	Action Three
CONESTOGA	13	Windows	KRV	14.28	Verify Load Rating of Glass		
MEADOW PARK	4	HAVAC	RT	12.88	Remove Ladder	Install Ladder with Swing Gate, Add Grip Tape	
HIGHLAND PARK	6	Skylight	AM	12.64	Skylight Covers	Horizontal Lifeline	Guardrails
MOUNTAIN VIEW	2	HVAC	RT	12.21	Telescopic Pole and Skylight Covers	Telescopic Pole and Horizontal Lifeline	
STOLLER	1	Skylight	BG	12.15	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	5	Skylights	BG	11.96	Verify Skylight Load Rating	Guardrail	Horizontal Lifeline
STOLLER	6	Skylights	BG	11.96	Guardrail	Designated Area with Horizontal Lifeline	Horizontal Lifeline
STOLLER	3	Skylight	BG	11.96	Verify Skylight Load Rating	Guardrail	Horizontal Lifeline
CEDAR PARK	8	Skylight	BG	11.22	Skylight Covers	Horizontal Lifeline	
CONESTOGA	4	HVAC	KRV	10.62	Verify Service Method		
CONESTOGA	13	HVAC	KRV	9.82	Portable Davit Arm		
MOUNTAIN VIEW	4	HVAC	RT	9.62	Portable Davit Arm	Skylight Covers	
CONESTOGA	1	HVAC	KRV	9.00	Portable Davit Arm		
CONESTOGA	2	HVAC	KRV	9.00	Portable Davit Arm		
CONESTOGA	3	HVAC	KRV	9.00	Portable Davit Arm		
MOUNTAIN VIEW	1	HVAC	RT	8.94	Portable Davit Arm	Skylight Covers	
HIGHLAND PARK	1	HVAC	AM	6.98	Portable Davit Arm		
MEADOW PARK	1	HVAC	RT	6.92	Portable Davit Arm		
MEADOW PARK	8	Skylight	RT	6.86	Skylight Covers	Horizontal Lifeline	
MOUNTAIN VIEW	3	HVAC	RT	6.71	Portable Davit Arm		
MOUNTAIN VIEW	5	HVAC	RT	5.67	Portable Davit Arm		

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