SCHOOL FACILITIES

GUIDELINES
FOR
UPGRADES TO BUILDING ELEMENTS AND SYSTEMS

February 2000

Alberta Infrastructure

Prepared by:
- Barr Ryder Architects & Planners – Prime Consultant
- Keen Engineering Company Ltd. – Mechanical Consultant
- Stantec Consulting Ltd. – Electrical Consultant

Draft – February 14, 2000

CONTENTS

1.0 INTRODUCTION

1.1 General

These guidelines are intended to provide assistance to the current decision making processes being followed by School Boards within Alberta.

The guidelines presented are not intended to be prescriptive in nature but rather, are to be read as descriptives to provide assistance in addressing the deficiencies identified by the recent facilities audit process.

This document is part of a compendium of information including the "Design and Construction Standards and Guidelines" document that collectively, will provide supplemental information to the various project decision makers.

1.2 Purpose and Scope of the Document

The purpose of this document is to provide reference guideline material that is appropriate to and consistent for upgrades to existing School Facilities.

These guidelines on their own, are not intended to apply to modernization projects. Rather they are to support what is generally the current practice of decision making by maintenance personnel for correcting critical building deficiencies.

The condition of existing school facilities has been assessed and critical upgrade elements have been identified within a facility audit based upon the primary objective **to provide safe, comfortable and operationally improved facilities within the funding limits available**.

The definition of the various evaluation levels used within the audit process is as follows:

.1 Level 1 – Emergency/Critical

Component represents an unacceptable, unhealthy or unsafe condition requiring immediate attention in order to ensure continued access, use and safety to staff, students and public.

.2 Level 2 – Poor/Unsatisfactory

Component has general to extensive deficiencies that impact on operational functions and/or may lead to health or safety concerns.

.3 Level 3 – Marginal

Component is marginally acceptable for intended use but has deteriorating conditions that will need to be addressed within the next 3 to 5 years.

.4 Level 4 – Good

Present condition of component has minor or no deficiencies, is performing well and will require only routine/average maintenance over the next 5 to 10 years.

.5 Level 5 – Excellent

Component meets all current requirements and will require only routine maintenance over the next 10+ years.

The team may determine that a guideline or standard, though normally applicable is not appropriate for a specific project. In such cases, the project team should propose an alternate that is consistent with the standards inferred in this document. Should the guidelines not address a specific technical issue, it is the upgrade team's responsibility to do so.

While not anticipated, the introduction of innovative designs or products should occur only after a thorough consideration of potential benefits, risks and costs by the project team.

1.3 Guiding Principles

The following represent the primary principles that apply to the application of this guideline document.

.1 This is not a modernization project and is not intended to modify existing spaces or finishes not clearly identified within the evaluation report as a Level 1, 2 or 3.

.2 The scope of work specifically deals with existing conditions from a critical health, primary safety and operational perspective.

.3 The scope of work relates to Upgrade Levels 1, 2 and 3 per the results of the specific facility's evaluation report as determined by Alberta Infrastructure.

.4 The objective is to undertake the minimum measures necessary in order to provide a safer, healthier and operationally improved facility within the funding limits available.

.5 Repair of the condition should be considered to be the typical solution as opposed to a replacement approach.

.6 Replacement should only occur where the component is obsolete, has failed to operate as intended and where repair is no longer possible or cost effective.

.7 Age is not reason enough for replacement.

.8 These guidelines are to be interpreted with professional judgement in order to evaluate, validate and better define the upgrade approach.

.9 Upgrade requirements are to be viewed holistically and thereby must ensure that the implications of corrective measures on all building elements, has been identified and considered.

.10 Where solution options are identified, final selection should be based on the most practical and cost effective means of achieving a Level 5 situation.

.11 Typically it is not anticipated that upgrades must comply with current building codes however discussions with the local authority should occur to determine specific requirements.

2.0 BUILDING ELEMENTS

2.1 Building Structure

.1 General

- Any structural elements deemed to be critical for the upgrade are to be designed in accordance with the basic requirements of the current Alberta Building Code.
- It is anticipated that structural upgrade is only necessary where life/safety concerns exist or where other upgrade requirements necessitate or creates a specific structural implication.

.2 Foundation

- Elements pertinent to geotechnical engineering are to be reviewed and approved by a geotechnical engineer.
- Make provision to maintain the integrity of existing structures and protect as necessary any existing services.

.3 Structure

General

- Steel connections outside air/vapour barriers should consider galvanized treatment.
- Ensure structural adequacy of support systems for such items as ceilings.
- Identify any anticipated movement related to structural design, to the upgrade team for incorporation of adequate allowances within other upgrade solutions.

Floor Construction

- Provide protection against corrosion for structural elements, which may be subject to spills or leaks of corrosive solutions such as that mechanical room floors.
- All floors separating spaces or occupied areas to be protected with appropriate fire separations.

2.2 Building Envelope

.1 General

- The intent is to minimize discomfort for occupants and to provide a reasonably energy efficient building where upgrade is necessary. Primary approach to the wall system is to minimize air leakage and to eliminate damage or intolerable conditions. Upgrading of the insulation is not usually practical or cost effective. A thermographic scan of the building may be considered where there are reported high energy consumption or serious discomfort problems.

- It is typically not economical to increase the insulation thickness due to questionable seal completeness (electrical or mechanical penetrations), thermal bridging, etc. The impact of adding insulation could be negative if condensation occurs in the assembly.

- The materials in an envelope assembly shall:

  .1 Be suitable for the environmental conditions.
  .2 Provide a service life consistent with their accessibility and expected building life.
  .3 Be compatible with each other and adjacent materials.

- Detail the envelope so that water runs off any exposed services and is not trapped in any hidden location.

.2 Roofing

- Repair or replace deteriorated areas of roofing identified as a Level 1, 2 or 3. This may be achieved by repairing or replacing damaged areas.

- Undertake additional further investigation of existing roof as necessary prior to determining upgrade program.

- Consideration to be given to an air seal, insulation and roofing system approach, especially when a similar approach is used on the existing exterior walls.

- Where applicable, design roofing system in accordance with the Alberta Roofing Contractors' Association Guidelines (ARCA).

- Provide a waterproofing membrane below all metal roofing and flashings. The minimum desired slope for near flat roof conditions is 1:50.

- Where possible, maintain a constant elevation around the perimeter of a contained roof area.

- Locate penetration and equipment curbs so that they do not impede drainage.

- Use removable precast units for ballasts in a protected membrane system.

- Any sloped roofs to preclude snow, ice and rainwater accumulation as well as falling of these elements creating safety concerns.

- Minimum desired slopes:

  .1 Low slopes stripped shingles 1:6.
  .2 Triple tabbed stripped shingles 1:3.
  .3 Cedar shingles 1:2.4.
  .4 Cedar shakes 1:2.
  .5 Metal as recommended by manufacturer.

- Design roof drainage to promote rapid removal of water providing a minimum of two roof drains per contained roof area wherever possible.

- When replacing soffits and fascias, prefinished aluminum should be considered as a low maintenance material.

- Size eavestroughs and rainwater leaders for the area of roof to be drained.

- Provide splash pads to drain water away from the building keeping pads and draining water clear of all walkways and pedestrian travel.

- Where roof to wall junctions occur, provide suitable membrane laps.

.3 Skylights

- Where appropriate, consider any needed replacement of skylights with clerestory windows.

- Curb supports, membranes, insulation, etc. to be appropriate to preclude water leakage and moisture penetration.

- New glazing systems should attempt to provide a minimum slope of 30 degrees with a double drainage system.

- Where glass is used consider Georgian wire or safety glass.

.4 Exterior Walls

- Upgrades to existing walls are intended to ensure structural stability and provide for minimal maintenance while achieving a Level 4 or 5 category.

- Consider placement of insulation to the exterior of structural elements in behind the wall cladding.

- As part of a determined upgrade element should existing finish repairs be necessary, painting is acceptable if considered to be a minor cosmetic solution and presents no maintenance concerns.

- Specific major upgrade requirements for exterior walls may necessitate further investigation so as to determine detailed problem solutions.

- If full replacement of exterior finish is necessary, the preferred solution would be to remove existing cladding to sheathing (replacement of sheathing as required), to install an air seal and insulation on the exterior of the structure. Rain screen design is the preferred method but to be considered only if appropriate in context with the overall upgrade program and existing conditions.

- Details for tie ins to all windows, doors, roofs and foundation should be similar and allow for future seamless upgrade and lapping to those adjacent areas not currently being upgraded.

- Provide necessary control and/or expansion joints.

.5 Windows and Doors

Windows

- Windows typically require replacement if signs of deterioration and/or distress exist, are non-operable or indicate significant frame deterioration.

- When replacing or adding windows consider orientation, ventilation, height above floor and details suitable for wall system.

Doors

- Exterior doors to be operable, in good condition and to have an acceptable weatherseal.

- When replacing, use low maintenance material.

2.3 Building Interiors

.1 General

- Upgrade to building interiors will typically be in support of other primary upgrade initiatives and must therefore be coordinated appropriately.

- Where practical, finish upgrades are restricted to the immediately affected areas and will terminate at a logical point.

- Affected areas are to provide necessary fire separations and fire resistance ratings as determined.

- Within areas affected by overall upgrade, finishes with visible signs of cracks, spalling, paint peeling, etc. should be patched, repaired and painted.

- Existing carpet and sheet flooring shall at a minimum represent a Level 4 and where replacement is identified, should achieve a Level 5 category. When replacing sheet goods, commercial grade shall be used with non-slip flooring in appropriate areas.

- Repair and/or replacement to gymnasia wood floors may require further investigation and reviews with industry leaders so as to preclude a reoccurrence of current problems.

- Floor, wall and ceiling penetrations are to be sealed and with consideration for any related fire separations.

2.4 Millwork

.1 General

- Where upgrade requirements have been identified for millwork specifically or where millwork is affected by upgrade to equipment, consideration of long term serviceability and maintenance is necessary.
- Specific criteria may vary depending upon the specific use and school type.
- For wood framed millwork solid material should be considered.

2.5 Other Building Construction

.1 Acoustics

- Where it is necessary to remove an existing ceiling, replace with a ceiling that meets the following criteria:

  .1 Select a suspended acoustic ceiling or other acoustic finish with a minimum Noise Reduction Coefficient (NRC) of 0.55 for all office space, corridors, junior and senior high classrooms.
  .2 Consider a suspended acoustic ceiling or other acoustic finish with a minimum NRC of 0.70 for all elementary classrooms.
  .3 Where partitions are only built to the underside of a suspended ceiling, select a lay-in ceiling product with a minimum Ceiling Attenuation Class (CAC) of 35.

- When replacing interior walls, ensure that new wall assembly provides adequate sound isolation to adjacent rooms. Typical sound isolation requirements are:

Room	STC
Classroom/Classroom	45
Classroom/Corridor	40
Office/Office	45
Music Room/Classroom	60
Classroom/Classroom (Frequent A/V use)	50

- Classroom walls should generally be full height.
- Perimeter heat cabinets require a solid barrier at wall junctions to prevent sound transfer.
- Avoid locating new duct shaft or pipe chase inside classrooms or other noise sensitive areas.

.2 Hazardous Materials

- Evidence of hazardous materials will necessitate further investigation and material testing prior to determining upgrade program.

- Based on seen material and age of facility, identify possibilities related to potential hazardous materials and determine an investigation plan.

- The upgrade program anticipates for those areas affected, that hazardous materials will be removed and where necessary materials replaced.

2.6 Building Site Work

.1 General

- Site upgrades are anticipated to relate to safety, health, environmental issues, preventive maintenance, and/or major building and site system operation deficiencies.

- Upgrade elements are to comply with appropriate provincial, municipal and environmental acts, codes and regulations.

- Surface finishes, aboveground and underground services, shall be in a suitable for intended use from both an operational and safety perspective.

- Positive drainage away from buildings is necessary. Address ponding and icing problems.

- Address vehicular traffic flow and parking issues.

- Following Alberta Labour's barrier-free design guidelines, address parking and access problems for persons with disabilities.

- Playground equipment, sports equipment (backstops, etc.), and fences to be in good operational condition and safe for the intended use.

- Overhead power or telephone lines should be free of obstruction (big trees, etc.).

- Coordinate any subsurface condition problems/solutions with a geotechnical engineer.

2.7 Mechanical

.1 Heating

General

- Upgrade existing heating systems or equipment, which are deteriorated or unable to maintain comfort conditions.

- Consideration to be given to upgrading components of existing systems wherever possible.

- Repair/replace unsafe systems/equipment.

- Reliability and generally accepted level of comfort shall be prime factors in any decision to upgrade/replace systems.

- Where a new system is proposed for a section of the school a central boiler plant complete with hot water distribution system is recommended. This does not preclude other options, which should take into account other systems within the school and school district where maintenance and familiarization are important considerations.

- Where existing insulation on equipment or piping is in poor condition or it is to be disturbed in a proposed modification and the presence of asbestos is suspected, advise the school authority. The school authority shall arrange for a qualified consultant to test the insulation and advise of an appropriate action.

Boiler Plant

- Existing systems, which are under capacity, shall maintain existing boiler plant where practical and incorporate additional equipment as appropriate.

- Where new equipment is required provide a minimum of two boilers and two circulation pumps each rated at 50% of system capacity. Pumps to be piped in parallel configuration.

- Ensure existing chemical treatment systems operate correctly. Provide new chemical treatment systems where applicable.

- Ensure adequate combustion air and proper flue gas venting are provided.

Heating Distribution

- Replace deteriorated and/or undersized piping as required.

- Provide isolation and/or balancing valves on all new/upgraded piping systems.

- Where there are heating deficiencies review cleanliness and operating efficiency of existing heating surfaces. If an increase in capacity is required, consider extending the existing heating surface wherever practical.

- Where new heating systems are required consider heating components that have the least impact on the building structure/layout.

- For replacement/upgrade of localized heating components consider replacement with similar equipment. If replacement of a complete school section is required, consider the most practical solution for the long term viability of the school.

- Provide heating/ventilation to crawlspace where necessary to resolve existing health conditions.

.2 Ventilation

General

- Upgrade existing ventilation components and/or systems, which are unable to maintain outdoor air, supply rates to satisfy the health of students and staff.

- Consideration shall be given to upgrading components of existing systems wherever possible.

- Check interior condition of ductwork to determine if duct cleaning is required.

- Where a new system is proposed for a section of the school a central air handling unit complete with ductwork distribution is recommended. This does not preclude other options, which should take into account other systems within the school and school district where maintenance and familiarization are important considerations.

- Where new ductwork or new equipment is proposed, noise control should be considered in the system design and equipment selection. Noise levels should be as close as is practical to the following:

  - Elementary Classrooms – RC25(N)
  - Junior/Senior Classrooms-RC35(N)
  - Gymnasium – RC35(N)
  - Music Room – RC25(N)

  Install vibration isolation for new rooftop equipment located above classrooms and gymnasium.

Air Handling Equipment

- Existing systems that require revisions to components to satisfy indoor air quality requirements should consider the following options where practical.

  .1 Replace existing in-room furnaces and in-room unit ventilators with new units/systems meeting present code requirements, i.e. packaged furnaces, rooftop equipment or central systems where a school section requires upgrading. To satisfy acoustic requirements, consider locating new equipment outside the classroom and provide acoustically lined supply and return ductwork.
  .2 Replace components within central ventilation such as: outdoor air intake; mixing dampers; heating coil.
  .3 Locate rooftop equipment over corridors or other none critical areas. Avoid placing equipment above classrooms.

- Where a new central ventilation system is required for a school section consider the practicality of the following options.

  .1 A return fan complete with an economizer cycle for free cooling.

.2 Use of air blenders to mix outside and return air and prevent air stratification.

.3 Use of gas fired heat exchanger with high modulation capacity to avoid increase in boiler plant capacity.

.4 Zone air systems in accordance with space function and occupied hours.

Humidification

- Replace non-functioning systems or systems with limited life expectancy. Consider practicality of equipment replacement.

- Provide humidification within new or upgraded ventilation systems where practical. Review potential impact on existing building structure. If an effective air/vapour barrier is not available then consider future implementation under a full modernization program.

- Ensure effective chemical treatment is provided for humidification systems.

Air Conditioning

- Existing components/systems that are deficient to be repaired/replaced.

.3 Plumbing and Drainage

- Replace plumbing fixtures that are chipped or cracked.

- Replace plumbing brass that is deteriorated or has no replacement parts available.

- Ensure that any upgrading to the hot water supply distribution provides temperature regulation or safe temperature supply to student and public fixtures.

- Where the main water service or any internal piping requires replacement provide copper or non-ferrous piping.

- Install suitable backflow prevention according to local bylaws and the National Plumbing Code.

- Rectify systems that are inadequate in capacity or deficient in operation.

- Ensure water treatment systems are functioning as originally intended. Upgrade/replace as appropriate.

Site Drainage

- Review storm discharge from school buildings and site. Rectify conditions, which create a hazard to the health and safety of students and staff.

- Remedial work to storm drainage systems shall be practical and consideration given to maintenance and normal school operation.

.4 Fire Protection

- Review reports/inspection reports from local fire department and authorities having jurisdiction for deficiencies in fire protection systems. Rectify deficiencies where required by code and where practical.

- Replace ineffective or outdated fire extinguishers.

.5 Controls

- Replace existing control systems/major components, which are deficient.

- Additions to existing control system required to resolve deficiencies/additions to main mechanical systems, i.e. additional ventilation equipment, should be similar in type to existing control systems.

- Where existing control systems have major deficiencies and/or replacement of main mechanical systems are necessary to a significant portion of the school, then installation of a new direct digital control system should be considered.

- Where a new direct digital control system is proposed due to deficiencies in mechanical systems to a section of a school, the control system in the remainder of the school shall be maintained wherever practical.

2.8 Electrical

.1 General

- Where electrical equipment shows signs of obvious damage and neglect or where unsafe, repair and restore equipment to a safe and acceptable working condition.

- Replace equipment only where repair is not possible or is economically impractical.

- Repair or secure all electrical equipment that is inadequately supported or mounted.

.2 Electrical Services and Distribution

Electrical Service

- Repair or restore service equipment that is unsafe, not mechanically secure, badly corroded or inadequately mounted. Only replace equipment that has deteriorated beyond repair or where present load demand exceeds service rating.

- Where an overhead Electrical Service requires replacement route the new service underground.

- Where single phase electrical service requires replacement provide a three phase service if it is determined that there are significant additional mechanical motor loads.

Power Distribution System Protection and Control

- Replace distribution equipment only if repair is not possible.
- Where the interrupting ratings of existing overcurrent devices are inadequate, replace with adequately rated device or install current limiting fuses.
- Reset the tripping values of adjustable breakers to realign with load.
- Repair distribution equipment that is not safely enclosed, bonded and isolated from contact with personnel. Replace open type distribution equipment accessible to the public.

Switchgear, Panelboards and Motor Control Centre

- Repair equipment showing signs of corrosion, mechanical damage, loose connections, exposed busbars or lugs, missing filler plates and openings. Replace the equipment only if repair is not possible.
- Repair defective breakers and fused disconnect switches. Replace only if unable to repair.

Transformers

- Repair damage or deficiencies in transformers. Repair malfunctioning components such as cooling fans, thermal sensing devices and vibration isolators.
- Replace or upgrade the ventilation where required to meet the heat rejection rating of the transformer.
- If repair isn't possible replace with new dry type transformers. New transformers are to be located to the exterior of the building.

Feeders

- Replace feeders only where sign of obvious overload is present. Use copper sized to meet voltage drop requirements for new feeders.
- Restore balance to parallel feeder conductors. If not achievable, replace the feeders.
- Repair deteriorated cable connectors. Replace defective cable connectors when repair is not possible.

.3 Wiring Materials and Methods

Raceways

- Repair and or replace damaged raceways or inadequate supports.

- Replace missing covers from conduit boxes and replace broken or damaged conduit bodies.

Conductors and Cables

- Replace any knob and tube electrical wiring with approved multi conductor cables or conduit and wire.
- Replace existing cables or conductors showing evidence of insulation failure or deterioration. The minimum size of replacement load conductors is #12 copper with 600 V RW 90 XLPE insulation.
- Replace any defective cable connectors.
- Repair damaged cable support equipment and only replace if not repairable.
- Repair the fire sealing of conduits and cables leaving a service space. Replace with one hour rated fire sealant where required.
- Repair any defective conductor terminations. Replace connectors if damaged or defective.

Wiring Devices and Equipment

- Repair defective devices, if possible.
- Tighten loose or detached receptacles, plugs, and cover plates.
- Replace broken or defective receptacles plugs and coverplates.
- Repair frayed or exposed equipment cords.
- If numerous loads are cord connected to a duplex receptacle provide new circuit complete with additional receptacles.

Grounding and Bonding

- Examine grounding and bonding system. Determine if grounding and bonding system is adequate for present and future electrical load demands.
- Repair loose connections and make mechanically secure. Provide adequate mechanical protection of grounding and bonding conductors.
- Replace corroded or inadequate bonding and grounding conductors, connectors, terminals and splices.
- Determine the continuity of the bonding and grounding system. Repair any breaks or high impedance points. Replace if repair is not possible.

- Examine the bonding of electrical equipment, metal raceways and metal cabletray. Provide adequate bonding if required. If the existing bonding is corroded and not repairable then replace with copper grounding conductors using compression type connections.

Transient Protection

- Provide transient voltage surge suppression only where sensitive equipment exists and there is a history of transient problems.

.4 Lighting

General

- Where lighting levels are inadequate, provide supplemental lighting or if cost effective replace lighting system.

- Small quantities of luminaires, ballasts and lamp replacements are maintenance and not part of upgrade. Where the majority of components in an area are deficient repair or replace as part of upgrade.

Luminaires

- Repair broken or defective components of luminaires. If repair is not practical than replace components.

- Replace defective luminaires that are impractical or uneconomical to repair.

- Secure luminaires that are inadequately supported to the structure of the building.

- Provide wire guards or impact resistant lenses for luminaires that are at risk of mechanical damage.

Ballasts

- Replace all ballasts that contain PCBs.

- Replacement ballasts to be high power factor, A sound rated electronic type.

- Adequately fasten ballasts that are improperly mounted or secured.

Lamps

- Where lamps are being replaced, use energy efficient lamps.

Lighting Control

- Repair defective lighting control equipment. Replace with new where repair is not possible.

- Replace damaged or defective lighting contactors.

- Replace damaged or defective line and low voltage switches, low voltage relays and occupancy detectors.
- If lighting control wiring is unresponsive, repair system.
- Replace defective photocells, timers and relays.

.5 Life Safety and Security Systems

Fire Alarm System

- Repair defective components of fire alarm system. If repair is not practical, replace fire alarm system with a system that suits the facility.
- Replace defective fire detection devices, signal devices (horns, bells, strobes, etc) and end of line resistors.
- Repair all ground faulted, open circuited, and short circuited fire alarm equipment.
- Where audible levels are not acceptable in normally occupied spaces then upgrade the fire alarm system to meet the minimum required sound levels.

Security System

- Repair defective components in the security control panel. If repair is not possible replace the components. Replace the control panel only if repair is not feasible.
- Repair defective or loose wiring to remote mounted sensing devices such as door switches, motion sensors, door release magnets, etc.
- If total replacement of the security system is necessary select security system compatible with other electrical elements in the building.

Emergency Lighting

- Repair defective emergency lighting battery packs. If repair is not practical then replace existing battery pack.
- Redirect the aiming of the heads to insure proper and adequate coverage of the space requiring illumination.
- Determine the condition of the batteries and replace if necessary.

Exit Luminaires

- Repair broken exit signs and replace failed exit lamps. Replacement lamps to be Light Emitting Diode type.
- Replace non-repairable exit signs with new Light Emitting Diode lamp types.

- Provide wire guards for exit lights subject to mechanical damage or impact.

.6 Data and Communication Systems

Telephone

- Repair defective or damaged telephone wiring and outlets. Replace where not practical to repair.
- Repair non utility owned telephone equipment.
- Notify the utility company of any problems or defects associated with their equipment.
- Wiring for new telephone wiring provide Category 5.

Data Wiring

- Repair defective or damaged data wiring and outlets. Replace where not practical to repair.
- Provide Category 5 wiring where existing data wiring is inadequate.

Cable Television

- Repair defective or damaged cable Television wiring and outlets. Replace where not practical to repair with new RG6 wiring.
- Notify the cable Television service provider of any problems or defects associated with their equipment.

Public Address System

- Repair defective Public Address controller. If existing system is wholly inadequate or non-repairable replace with a programmable solid state system.
- Repair or if necessary replace defective speakers and Public Address wiring.
- Secure loose or poorly secured Public Address equipment to the building.
- Increase the number of speakers and remote control stations only if the present numbers are not adequate.

Clock Program System

- Repair defective clocks; if repair is not possible, replace with new battery powered clocks.

.7 Motor Protection and Control

Motor Starters and Motor Control Centre

- Repair defective motor starters, which have replacement parts readily available. Replace, if parts are not available.

- Repair damaged Motor Control Centre. Repair corroded termination points, loose connections and corroded enclosures. If repair is not practical replace the Motor Control Centre. New Motor Control Centre to be Class 1 Type B wired.

Variable Frequency Drive

- Repair Variable Frequency Drive if not functioning. Replace Variable Frequency Drive only if repair is impractical.

- Provide a DV/DT output filter on the Variable Frequency Drive where there are signs of damage due to high DV/DT.

- Provide input filtering only where Total Harmonic Distortion values are above the IEEE 519 standard at the Motor Control Centre and harmonic current is a problem in the facility.

.8 Site Electrical Equipment

Lighting

- Repair broken lighting controllers and replace defective photocells.

- Replacement luminaires to have high impact and vandal resistance rating.

Automobile Heater Receptacles – Parking Lot

- Repair broken wiring and loose connections.

- Repair broken receptacles, enclosures, cover plates, conduits and condulets. If repair or refurbishing is not possible than replace the equipment.