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This document has been produced for the owners of "The 501", Strata Plan LMS 4050 by Spratt Emanuel Engineering Ltd. The contents of this manual are intended to assist the owners and their agents in the care and maintenance of their building at 501 Pacific Street, Vancouver, BC only. Spratt Emanuel Engineering Ltd. is not responsible for the implementation of a maintenance program nor does it assume responsibility for the effectiveness of such a program.

The information in this Manual is intended for the sole use of Strata Corporation LMS 4050, who further agrees that it will indemnify and hold harmless Spratt Emanuel Engineering Ltd. from any and all liability which Strata Corporation LMS 4050 may incur as a result of the use or misuse of this information.

1.0 INTRODUCTION

1.1 TERMS OF REFERENCE

Spratt Emanuel Engineering Ltd. was retained by Strata Plan LMS 4050 to perform a building condition survey at The 501 located at 501 Pacific Street, Vancouver, B.C. and to develop a 25 year maintenance manual for the building.

The objective of providing this maintenance manual is to assist the Owners of The 501 with the design and implementation of a building exterior maintenance program. The maintenance program is intended to keep the buildings in good and serviceable repair and to maximize the expected life span of the exterior building systems and materials. This manual includes information relative to the materials utilized in the construction of The 501 building in addition to provide an estimate of projected costs associated with the normal building maintenance and repair.

1.2 SCOPE OF SERVICES

The scope of our services was to provide a building envelope review of The 501 and to develop a 25-year building maintenance plan based on these review. The review included a visual investigation of the exterior building components, assemblies and materials. From our findings during the building envelope review, we are providing information relating to the necessary maintenance functions for the building envelope. This Manual is intended to assist the Owners in developing an item specific maintenance program that would include:

- ***Verification of building materials utilized in the construction of the buildings***
- ***Annual maintenance requirements of the various building components***
- ***Life expectancy of building materials***
- ***Schedule of estimated expenditures for budget purposes***

1.3 TERMINOLOGY

There are a number of building construction terms which are used in this manual that may not be familiar to the average reader; therefore they are described below for reference purposes.

Balcony refers to a horizontal surface generally exposed to the outdoors and projected from the building so that it is not located over interior areas.

Cladding refers to a material or assembly that forms the exterior skin of a building wall. Examples of cladding types include stucco, siding and brick.

Deck refers to a horizontal surface area designed for pedestrian traffic, which is exposed to the outdoors and located over an enclosed interior area.

Drained Cavity (or rainscreen) refers to a building cladding system installed in such a way as to provide a space between it and the wall sheathing beneath. The space, or cavity, is usually vented at each floor level and provides a path for air circulation and drainage for any incidental water that may enter the wall system.

Efflorescence refers to the dissolved mineral salts, which appear as a white dusty stain on the surface of cementitious materials such as concrete, brick and stucco. Water collects these mineral salts as it passes through the material and deposits them on the surface when it evaporates.

Envelope refers to the exterior portion of those parts of a building which separate interior areas from the exterior atmosphere and include such things as windows, doors, walls, and roofs.

Flashing refers to sheet metal or other material used in roof and wall construction which is designed to shed water. Different types of flashing are:

- **Cap flashing** – installed on top of a wall, pier, column or chimney
- **Saddle flashing** – a right angle piece of flashing installed at the transition of a horizontal to vertical surface.
- **Head or sill flashing** – installed at head or sill of a window or other through-wall penetration such as an exhaust vent.

1.3 TERMINOLOGY– Continued

- **Base flashing** – installed at the base of a wall.
- **Step flashing** – installed under one material and lapped overtop of another material below in a shingle fashion.
- **Through-wall flashing** – installed in a rain-screen wall system typically at each floor level. This flashing is intended to shed water from the moisture barrier plane of the cavity to the exterior face of the wall in addition to providing weather protection at the top of each cavity.

Gum-lip – refers to a method of sealing a metal flashing to a wall surface whereby the top edge of the metal flashing is bent outwards to form a lip that accommodates a caulking sealant.

Maintenance – refers to a regular process of inspection, repair and renewal of aging and deteriorating materials, products and building systems.

Membrane – typically refers to a continuous waterproof material used to prevent water penetration.

Scupper – refers to a horizontal drain, which generally passes through a wall. They are typically made up of a piece of pipe or a metal trough.

Sheathing – refers to a sheet material such as plywood, which is used to cover the framing assemblies of a roof or wall system. The sheathing provides structural stiffness in addition to providing backing for the cladding or roofing.

Substrate – refers to an underlying material, which is often relied on for adhesion of the covering material.

UV – refers to ultra violet radiation (from the sun), which has a degenerative affect on many building materials.

1.4 BUILDING DESCRIPTION

The subject building is a 7 year old mixed-use development consisting of 285 residential units in a 32-storey high-rise building and 10 low-rise townhouse units. Below the townhouses on Richards street, are storefront commercial units. The complex sits above a four-storey below-grade parkade. The complex shares a landscaped courtyard, which includes a beach volleyball court, and a small outdoor pool, situated on a second storey roof.

Roofs typically are inverted roof membranes with fibre reinforced liquid-applied urethane membrane covered by rigid insulation and ballast of either rock or landscape materials.

Windows and balcony doors at the 501 are thermally broken aluminium framed with insulated glazing units.

Building Description:

Building Address	501 Pacific Street, Vancouver, B.C.
Legal Description	Unknown
Lot Zoning	High-rise residential
Architect	Unknown
Owner	Strata Plan LMS 4050 – The 501
Building Type	High-rise apartments and low-rise townhouse condominiums
Principal Occupancy	Residential strata units
Other Occupancy	Commercial retail units, along Richards St.
Date of Construction	2001
Applicable Building Code	Vancouver Building By-Law 8057, 1999
Number of Suites	295, 285 High rise, 10 townhouse
Type of Construction	Non-combustible, reinforced concrete high-rise
Sprinklered	Yes
Window Type	Double glazed aluminium frame
Window Colour	Blue-grey, aluminium
Number of Storeys	32 stories
Adjoining Properties	North: high rise residential zoned property East: Richards Street South: Pacific Street West: lane
Parking	4 level underground parkade

2.0 MAINTENANCE OVERVIEW

2.1 General

The maintenance of building exteriors has long been recognized as an important factor in the overall performance of a building structure. It is referred to and described in a number of technical publications as being crucial to the long-term performance of building assemblies and materials.

Regardless of the design or the materials used, all exterior building assemblies require maintenance in order to realize their full service life. Building exteriors are subjected to harsh environmental conditions such as wind driven rain and snow in addition to extreme temperature variations and air-borne contaminates. These conditions breakdown materials and therefore, building inspection and repair is a continuous requirement of building owners if they expect to realize longevity from their buildings and cost effectiveness from their operating budgets.

Building exteriors are made up of a variety of building materials and components attached together through various means into what are commonly referred to as assemblies or systems. They are designed and constructed to provide separation of the interior environment from the exterior environment. They control a number of factors such as temperature, humidity, air pressure and moisture and are instrumental in providing the comfortable atmospheres that we enjoy in modern buildings. The relentless task of maintaining the serviceability of these assemblies requires a basic understanding of their function and the prudent implementation of a program that regularly addresses the requirements of each component in the assembly. Therefore, an exterior maintenance program should include a review process to identify the condition of materials and the potential for problems, a repair process to renew damaged and deteriorated materials and a replacement process to replace entire systems, such as roofs, when their expected service life has been achieved.

2.2 Building Review

In order to assess the condition of exterior building materials and identify items requiring repair, visual inspections should be carried out at regular intervals. The frequency of inspections varies depending on the nature of the item being reviewed. Items that are critical to the performance of a waterproofing system or moisture barrier, such as sealant or a roof drain, require more frequent inspections to minimize the potential for moisture related damage from a failure of the system. Whereas items that lend themselves more to the aesthetics of a building, such as paint, are less critical and can be renewed with less frequency.

The deterioration of building materials is often identifiable during a brief visual inspection by a change in their appearance. Fading, discolouration, cracking and separation can all be signs of potential problems in certain building materials. When items are identified as needing repair or replacement, proper documentation of the specifics is fundamental to a successful maintenance program. Recording the date and exact location of the observation, in addition to the nature of the abnormality are all-important aspects of the inspection process. The function of particular materials and the importance of those materials to the performance of the building assembly are covered in more detail later in this manual. Additionally, abnormalities associated with specific materials are also covered in greater detail later in this manual.

2.3 Building Repair

When maintenance repair requirements on building assemblies that are critical to moisture protection have been identified through the inspection process, remedial action should be taken at the earliest opportunity. Repairs may take the form of a temporary or interim fix, or be of a more permanent nature depending on what point in the life expectancy of the assembly the repair requirement becomes evident. Repair requirements on less critical exterior building components should be recorded for scheduling and future reference purposes. Keeping record of what remedial action is required or has been taken on the building and frequency of when it was performed will prove extremely helpful in evaluating annual maintenance requirements and budget expenditures. The scheduling of major renewal projects will be greatly influenced by the information contained in the maintenance records. For example, increased frequency in minor roof repairs is an indication that the roof system is nearing its life expectancy and scheduling for replacement should be planned.

2.4 Material Replacement

A regular program of building care includes maintenance and repair as well as a plan for replacement. Replacement planning refers to the regular replacement or renewal of components such as roof or deck membranes or paint, which have finite life expectancies.

Renewal projects are generally of a large scale and should therefore be scheduled and budgeted well in advance of their requirement. It is important to recognize that even minor repair items can have a significant impact on the eventual cost of replacement projects. Additionally, the timeliness of replacement projects can also significantly impact the cost.

2.5 Budgeting

Budgeting for exterior building maintenance should be categorized as a separate line item in the operating budget for a strata property so that the significance of this requirement is not overlooked. The complexity of the building exterior maintenance function, which includes the eventual replacement of major building components, such as roofs, requires advanced planning to estimate the long term costs associated with this budget category. A good understanding of the costs associated with building renewals and replacements in addition to the life expectancy of the different materials is beneficial to accurately forecasting major expenditures. Amortizing these expenditures over a long period of time mitigates their financial impact on the building owners and insures that funds are available for repairs when they are most needed. A schedule of costs associated with building maintenance is included later in this manual.

3.0 MAINTENANCE OPERATIONS

3.1 Inspection

Inspections of the building exterior need to be performed by each individual Owner, in addition to a designated maintenance body. Typically, the changing of the seasons presents an excellent opportunity to review exterior building components, and assess the impact of the latest environmental conditions on their performance. It is important to be aware of the age of specific building materials as each has its own life expectancy. Signs of aging include fading or discolouration, blistering, peeling, cracking and separation, which are all things that an inexperienced homeowner can easily identify. Cleaning the building exterior is a good means of providing an opportunity to observe building materials up close.

Accessibility to the building exterior is an all-important issue. Inspection of limited common areas, such as balconies, can and should be part of every home Owner's responsibilities. However, home Owners cannot reasonably conduct inspections of roofs and high wall areas, therefore designated Owners or contractors must be used to review these areas. Some contractors who perform regular building maintenance functions, such as window cleaners, can sometimes be utilized in the maintenance review process. However, there can be drawbacks from utilizing contractors that may not be experienced or knowledgeable in a certain area or from contractors that stand to benefit from repair work that they may recommend.

Independent consultants specializing in building maintenance and investigation are often equipped to access difficult areas and can provide detailed information and an objective opinion.

3.2 Scheduling

The following table outlines the minimum frequency of inspections that should be done in order to assess the condition of noted building components. It is not possible to itemize all the specific areas on a building where a potential problem may develop or the scenarios that may constitute a potential problem; therefore it is important to utilize qualified personnel in the maintenance review process periodically.

MAINTENANCE SCHEDULE

Component	Items to Review	Frequency
Sealant	Inspect sealant for cracking, loss of adhesion, bulging or lack of flexibility.	Annually
Windows and Skylights	Inspect weather-stripping, seals, weep holes and especially perimeter sealant and flashing slope.	Semi-Annually
Exhaust Vents	Inspect for lint accumulation in screens, corrosion and perimeter sealant and flashing slope as well as the occurrence of dripping water	Annually (after 10 years)
Doors	Inspect hardware, weather-stripping and alignment.	Annually
Flashings	Inspect for corrosion, proper slope and joint sealant failure.	Annually
Non-exposed Deck & Roof Membranes	Inspect for damage, wear, blistering, peeling or splitting.	Annually
Drains	Check for drain blockages.	Annually
Concrete	Inspect for cracking, spalling or staining.	Annually
Paint	Inspect for staining, discolouration, fading, chalking, peeling, cracking or blistering.	Annually

4.0 SCHEDULE OF COSTS

Budgeting for exterior building maintenance should be categorized as a separate line item in the operating budget for a property so that the significance of this requirement is not overlooked. The complexity of the building exterior maintenance function, which includes the eventual renewal of major building components, such as roofs, requires advanced planning to estimate the long-term costs associated with this budget category. A good understanding of the costs associated with building renewals and replacements, in addition to the life expectancy of the different materials, is beneficial to accurately forecasting major expenditures. Amortizing these expenditures over a long period of time mitigates their financial impact on the building Owners and insures that funds are available for repairs when they are most needed. The schedule of costs associated with building maintenance outlined below is intended to provide a guideline for budget purposes. Actual costs will depend on the frequency and thoroughness of the regular maintenance procedures.

DESCRIPTION	ANNUAL AMORTISED COST	FREQUENCY	REPLACEMENT COST
Inspections by qualified personnel	$4,000	1 Year	N/A
Cleaning all exhaust vents	$2,000	6 Months	N/A
Sealant renewal	$30,000	10 Years	$300,000
Replacement of double glazing /Windows/Doors	$75,000	Annually after 10 Years	$3,000,000
Miscellaneous repairs i.e. flashings	$2,000	50 Years	$100,000
Cleaning wall surfaces	$30,000	10 Years	$300,000
Replacement of deck membranes	$60,000	10 Years	$600,000
Parkade concrete maintenance	$8,000	50 Years	$400,000
Roof membrane replacement	$6,000	35 Years	$210,000
Deck Guardrail Replacement	$10,000	50 Years	$500,000
Dow Corning AllGuard	$60,000	Once	$600,000
TOTAL/Annum	**$287,000**		

4.1 Overall Maintenance and Renewal Program

5.0 INSPECTION RECORD FORMS

5.1 Homeowner Inspection Check List

5.2 Common Area Inspection Check List

5.3 Maintenance Report Form

HOMEOWNER INSPECTION CHECK LIST

Suite #:_____ **Inspection Date:**_____

Conducted by:_____ **Phone:**_____

Component	Items to Review	Condition	
		Acceptable	Not Acceptable
Sealant	Inspect sealant for cracking, loss of adhesion, bulging or lack of flexibility.		
Windows and Skylights	Inspect weather-stripping, seals, weep holes and especially perimeter sealant and flashing slope.		
Exhaust Vents	Inspect for lint accumulation in screens, moisture, corrosion and perimeter sealant and flashing slope.		
Doors	Inspect hardware, weather-stripping and alignment.		
Flashings	Inspect for corrosion, proper slope and joint sealant failure.		
Balcony Membranes	Inspect for damage, wear, blistering, pealing or splitting.		
Flat Roofs	Inspect for physical damage, blistering or cracking and drain blockages.		
Concrete	Inspect for cracking, spalling or staining.		
Paint	Inspect for staining, discolouration, fading, chalking, peeling, cracking or blistering.		

Any component deemed not acceptable should be explained in detail on the reverse of this form.

COMMON AREA INSPECTION CHECK LIST

Building Elevation:_____ **Inspection Date:**_____

Floor Number:_____ **Suite #:**_____

Conducted by:_____

Component	Items to Review	Condition	
		Acceptable	Not Acceptable
Sealant	Inspect sealant for cracking, loss of adhesion, bulging or lack of flexibility.		
Windows	Inspect weather-stripping, seals, weep holes and especially perimeter sealant and flashing slope.		
Exhaust Vents	Inspect for lint accumulation in screens, moisture, corrosion and perimeter sealant and flashing slope.		
Doors	Inspect hardware, weather-stripping and alignment.		
Flashings	Inspect for corrosion, proper slope and joint sealant failure.		
Balcony Membranes	Inspect for damage, wear, blistering, peeling or splitting.		
Flat Roofs and Decks	Inspect for physical damage, blistering or cracking.		
Drains	Check for drain blockages.		
Concrete	Inspect for cracking, spalling or staining.		
Paint	Inspect for staining, discolouration, fading, chalking, peeling, cracking or blistering.		

Any component deemed not acceptable should be explained in detail on the reverse of this form.

MAINTENANCE REPORT FORM

Date:_____

Maintenance Required:

Location:

Reported by: **Suite Number:** _____

Action Taken:

Date Completed:_____ **Approval:**_____