

1-1-2007

State-wide schools' maintenance audit in Victoria, Australia: The framework and process

Jim Smith

Bond University, jim_smith@bond.edu.au

Peter Stewart

Department of Education and Training

Follow this and additional works at: http://epublications.bond.edu.au/sustainable_development



Part of the [Architecture Commons](#)

Recommended Citation

Jim Smith and Peter Stewart. (2007) "State-wide schools' maintenance audit in Victoria, Australia: The framework and process" *Structural survey*, 25 (1), 24-38.

http://epublications.bond.edu.au/sustainable_development/54

ARTICLE FOR STRUCTURAL SURVEY

Statewide Schools' Maintenance Audit in Victoria, Australia: The Framework and Process

by

Jim Smith

Professor of Urban Development, School of Sustainable Development,
Bond University, Queensland, Australia

Peter Stewart

General Manager, Schools Resources, Department of Education and Training,
Melbourne, Victoria, Australia

ABSTRACT

Purpose: To provide details of the process involved in preparing a comprehensive maintenance audit of school buildings and facilities in a state government education department. At the end of 2005 the Department of Education and Training of Victoria carried out a state-wide audit of all the building maintenance items in all its primary and secondary schools. This audit, or survey, covered nearly 1,700 different school campuses spread across the Melbourne metropolitan area as well as all the regional towns and areas of the State, which is approximately the size of the UK.

Design /Methodology / Approach: This paper presents the framework and logistics of the survey or audit, which relied on integrating a property management system with a consistent approach to the definition of maintenance and its costing. The use of visual illustrations of maintenance categories is a feature of the process and this study.

Findings: The work was completed in three months and drew upon the Department's two computerized property management and asset systems, the *Physical Resource Management System* (PRMS) and the School Asset Management System (SAMS). The Department adopted an IT-based approach that integrated the building element based maintenance items with electronic plans and a standard costing approach using hand-held pen-activated computers under the control of the maintenance auditors. The process of conducting the maintenance audit has resulted in the most comprehensive review and updating of all the maintenance requirements in school buildings. It has provided real and accurate costing of this work on a fair, methodical and consistent basis. The size of the final costs in each maintenance category have allowed funding to be refined, targeted and focused on many key and important areas.

Research Limitations /Implications: Whilst categories of different maintenance work are provided in broad terms, for confidentiality reasons the client organization would not permit the financial values of these categories to be published.

Practical Implications: Examples of the categorization and analysis of maintenance items are included to illustrate and demonstrate the method of approach. Details of the extensive auditing process described provide insights for any large organization with widespread facilities and property assets to adopt a similar approach.

Originality /Value: The process is an exemplar for an integrated property management and maintenance auditing system using IT and the practical skills of maintenance inspectors.

Article Type: Case study.

Keywords: Maintenance; asset management; survey; school buildings

ARTICLE FOR STRUCTURAL SURVEY

BACKGROUND

The Department of Education and Training of Victoria has 1,698 primary and secondary school campuses spread across the state and in the Melbourne metropolitan area. Identifying and organizing the maintenance of the buildings and the grounds on these schools is a large and complex task. At the end of 2005 a school buildings maintenance audit in the state of Victoria involved three principal contractors, 52 individual auditors inspecting 6.8 million square metres of floor space in 26,600 buildings, all within a three month time period.

A critical factor in assessing the type and extent of maintenance on each school property is the management and updating of the Department's schools property database, the Physical Resource Management System (PRMS). The assessment of the condition of schools is carried out by the updating of this database by periodic audits. Audits have been completed in 1997/98, 2000/01 and most recently at the end of 2005. These audits provide details of the condition of all building elements, many sub-elements, external works and services for all government schools, together with an assessment of any immediate future works that may be required to maintain the facilities in a serviceable condition to allow them to function effectively.

An independent experienced inspector familiar with maintenance work and activities carries out the audit. The auditor works closely with the regional offices and schools, but the assessment is an independent one where they are required to identify works and priorities in accordance guidelines published by the Department in its *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines* (DET, 2005) prepared in conjunction with a private consulting firm, Sinclair Knight Merz Pty Ltd.

The purpose of the of the regular audit process is to provide data, not only to the Department centrally, but also with the data and tools to assist the Department and schools themselves in their own planning and reporting of maintenance works in the decentralised system used in Victoria. The standardized, transparent and consistent process exemplified in the audit approach adopted also provides a fair and equitable basis for allocating suitable funding to all schools within the state government system.

THE PROCESS

Maintenance for the purposes of the audit are, 'the activities that may be required now or in the foreseeable future to ensure an element/sub-element is in a serviceable condition that fulfils its original design intent' (DET, 2005:16). In addition, the guidelines emphasise that maintenance work is directed at keeping the buildings, services and grounds in a sound working condition appropriate to maintain their functionality, but not necessarily operating as efficiently or effectively as a new element or sub-element.

The preservation of function and functionality in school spaces and elements is stressed with the following guidance. '... the condition of the element should be such that the room, building or site can be reasonably and safely used for its originally intended purpose, without reasonable compromise' (DET, 2005: 16).

The auditor on every school campus reviews all the buildings and grounds on the site under three main categories:

ARTICLE FOR STRUCTURAL SURVEY

- *Site* – consists of fences, pavings, sealed and unsealed areas and services to the whole school such as stormwater, drainage and water services;
- *Building(s)* – exterior or external parts (elements) of the buildings consisting of the structure, external walls, windows, roof, verandahs and services;
- *Rooms of buildings* – all internal spaces including ceiling, floors, walls, doors, fittings and equipment, electrical and mechanical services.

In addition to assessing the building the auditor also notes the need for any specialist inspections carried out by consultant engineers and other specialists on water supply, sewerage, stormwater, gas, heating and cooling systems, lifts and transportation and electrical work. These audits need specialist assessments and are carried out with the results also included as part of the overall school audit.

The audit is carried out with the assistance and support of a pen-activated computer (PAC). See Figure 1 for details of the equipment. For information this model is the *Panasonic (National) Toughbook CF-18 Standard*.

Figure 1 PAC used for the schools audit inspections



These hand-held computers contain the all audit software, electronic plans of the school, the assessment guidelines in electronic form, all the individual physical parts and services of a

ARTICLE FOR STRUCTURAL SURVEY

site, building and room (elements¹) and any other information relating to the audit. The software contains a database that provides the auditor with most of the information and decision-making in a default format for the survey and the costing of maintenance work. This software integrates a standard automated, approach with consistency that takes a large element of error and inaccuracy out of the process.

The auditing firm (three principal ones used) carrying overall responsibility for the audits within a region or several regions ensured that each auditor was competent to carry out these inspections and was properly trained in the use of this software for data collection. The e-plans of each school on the audit software used by the auditor for assessment of maintenance work are a simplified version of the Department's centralised *School Asset Management System (SAMS)*. SAMS holds all electronic plans and building room data for every school in the state. The auditors hold these e-plans on the PAC for access and use as they conducted their assessments on site.

The use of the PAC in practice by an auditor or inspector is shown in Figure 2.

Figure 2 An Inspector using the PAC on site



Where changes have been carried out in a school building or space the e-plan software allows the auditor to mark buildings and rooms that have been modified, demolished or removed from the site. When a new building has been constructed or 'relocatable' buildings² have been

¹ An element is defined as a 'major component or part common to most buildings which fulfils the same physical purpose (function) irrespective of its construction or specification' (Smith and Jaggard, 2006 and Tate and Flanagan, 1997). There are 47 standard building elements and include such elements as external walls, roof, columns and upper floors (AIQS, 2000).

² In Victoria (and many other states in Australia) prefabricated fully fitted out *relocatable* classrooms allow the Department of Education to cope with expanded enrolments quickly by organizing the delivery of additional classrooms to growing schools at the beginning of the school year. These may be new classrooms, or they may be relocated from a school with declining enrolments where this relocatable classroom is no longer needed, or justified by student numbers. These relocatable classrooms allow the Department to respond to changing spatial demographic patterns.

ARTICLE FOR STRUCTURAL SURVEY

placed on site or a building has been extended the e-plan software allows the auditor to sketch the changes on the e-plans. Similarly, where new spaces have been created within the building or existing rooms have been sub-divided the auditor can make the necessary changes to the e-plan and include these changed spaces in the audit and these changes then inform the SAMS plans to the amendments.

A flow chart showing the auditing process with the on site activities is shown in Figure 3. The processes involved in the element analysis (condition assessment) and remedial action forms the central focus of these activities and the basis of these analyses are described next.

ELEMENT ANALYSIS

Condition

The auditor (inspector) methodically works through each element in turn for the three major groupings of *site*, *buildings* or *rooms* as noted earlier in the maintenance guidelines and shown on the first column of the flowchart in Figure 3. The auditor is guided by the *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines* (DET, 2005) held on software in the hand-held computers illustrated earlier and decisions about each element's and sub-element's condition and priority are methodically recorded and automatically transmitted back to the Department for collation and analysis.

So, for instance in the element Substructure the auditor must check through the various sub-elements as follows:

- Footings – concrete;
- Slabs – ground;
- Stumps – concrete;
- Piers;
- Stumps – timber;
- Bearers and joists;
- Other.

The condition of the element is reviewed with advice, guidance and illustrations given in the PRMS manual. The element is assessed based on its appearance (visible damage, wear and tear) and is classified under one of four graded *condition* headings that will determine the maintenance action required as follows:

- GOOD – nothing needs to be done. No further auditing action is needed.
- FAIR – starting to show signs of wear and tear. No maintenance reason to repair or replace at this time.
- WORN – substantially deteriorated, but still operational and functional. In the short term it still achieves its intended function.
- POOR – failed and inoperative; no longer performs its required function. Repair, replace or service.

Also see the second column of the flowchart in Figure 3, which shows the steps involved in an element analysis.

ARTICLE FOR STRUCTURAL SURVEY

To illustrate an example of an item or element in GOOD condition (that is, requiring no maintenance) a typical one is shown below for concrete steps. This example is to guide the inspectors in their assessments and is taken from the *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines* (DET, 2005).

When an element has been recorded as in GOOD condition then it is automatically included as part of the Department's INELIGIBLE category of work and is excluded from any consideration in the maintenance budget. That is, no maintenance is costed for this item.

For items outside the professional capabilities of the inspector and requiring a specialist report or audit from an engineer then these are entered in the audit and the project manager appointed to that area organizes this specialist audit to be completed. See column 2 of the flowchart in Figure 3.

Concrete Steps

No major break-up of surface, nosings, etc.

Stairway is fully functional

Condition = GOOD
Priority = NO
PRIORITY



If the item or element is not in GOOD condition, then one of the three remaining conditions of FAIR, WORN or POOR has to be selected as noted above. When one of these conditions is selected the *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines* (DET, 2005) requires that *remedial action* for the maintenance work required has to be determined. Column 5 of Figure 3 shows the process involved in this next step under the heading of, 'Select Remedial Action'.

After selecting a sub-element (not in good condition) the auditor inserts the quantity of the remedial action required to the maintenance item. Since the item is not in good condition, then either a condition of fair, worn or poor has to be chosen. These conditions are described above.

The next step after defining the condition is to select one of the four priorities within each condition that matches the element, or sub-element being inspected.

Determining Priority

Once the condition has been determined the auditor has to assess the priority of the remedial action to overcome the fault by identifying the impact of the chosen condition of the on the functionality or performance of the space or area. See column 5 on Figure 3.

ARTICLE FOR STRUCTURAL SURVEY

Assessing the priority of an item of maintenance requires the auditor to take account of the following four characteristics:

- Obvious safety issues such as risk, structural hazards, mobility, fire, personal safety.
- Decrease in the performance, functionality or usability of the space.
- Potential consequential damage to other elements such as a leaking roof may damage ceilings, walls, floors and equipment.
- Aesthetics, which will depend on location or visibility. However, aesthetics on their own will not warrant a high priority.

Each fault is assessed and reviewed individually and allocated a priority related to the urgency of the work categorized under four graded headings starting with the most urgent (A) down to the lowest priority (D) of least urgency. These four levels of priority are summarized as follows:

- **PRIORITY A**
The current condition of the element has a *major impact* on the functionality or structural integrity of the area or space. These faults are likely to involve safety or risk issues and significantly limit the use of the space.
- **PRIORITY B**
The element is likely to have *some effect* on the functionality of the area or space. Types of fault include damaged finishes, failed painting on external timbers and badly worn carpet.
- **PRIORITY C**
This element is likely to have a *lesser effect* on the functionality of the area or space. Faults include failing of external painting on timber or carpet is badly worn or stained in a prominent area.
- **PRIORITY D**
This element is likely to have a *minimal effect* on the functionality of the area or space. Faults include failing of external painting on masonry or carpet is badly worn or stained in a non-prominent area.

Samples of POOR condition elements for each priority are show below taken from the *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines* (DET, 2005). The same process of priority assessment would also apply in the same way through the other two conditions of WORN and FAIR. A comprehensive set of examples of maintenance and faults is also contained in the Manual.

- **PRIORITY A:** *major impact* on the functionality or structural integrity of the area or space.

Down pipes

Damaged down pipes not capable of carrying storm water. Leaking on to ground and compromising the use of the area. Potential safety issue. Requires replacement.

Condition = POOR (failed or inoperative; no longer performs its required function).

Priority = A (Risk or safety issues, limit use of space)

ARTICLE FOR STRUCTURAL SURVEY



- **PRIORITY B:** *some effect* on the functionality of the area or space.

Ceiling Plasterboard

The ceiling has deteriorated. Some holes are apparent. Investigate cause of failure (water damage) and recommend repairs prior to work to ceiling. Functionality is affected to a minor degree. If this fault was in a prominent area of school such as main entry or staff areas then it should be given a higher priority (A).

Condition = POOR
Priority = B



- **PRIORITY C:** *lesser effect* on the functionality of the area or space.

ARTICLE FOR STRUCTURAL SURVEY

Windows

The fly screen is no longer functioning. This area is not a food preparation area or mosquito problem area where strict standards apply. The condition may cause some minor annoyance to room occupants.

Condition = POOR
Priority = C



- **PRIORITY D:** *minimal effect* on the functionality of the area or space.

Supply Mains

Exposed mains wiring accessible to students due to poor construction methods. Functionality of area marginally compromised due to height of wiring.

Condition = POOR
Priority = C/D



Other Condition Categories

Worn Condition Priority D Work

To repeat the definitions from the *Physical Resource Management System (PRMS): Maintenance Assessment Guidelines* (DET, 2005) a Worn condition is where the element is ‘... substantially deteriorated, but still operational and functional’. Priority D is where the condition has ‘... minimal effect on the functionality of the area’.

The type of maintenance work in category Worn D, which has been excluded from attention by present budgetary review are shown below for illustration purposes.

ARTICLE FOR STRUCTURAL SURVEY

Steps

The stairway is no longer in use, but students still sit on it, etc. Step edges are broken, possibly a minor slipping hazard. The stair is not used in emergency.

Condition = WORN
Priority = D



Fair Condition

Maintenance in the Fair category still show signs of wear and tear, but generally do not affect the functionality of the building or spaces at the time of the audit. However, at some time in the future these items will move into the Worn and Poor category if they are not rectified.

Examples of maintenance in the lowest inclusive condition category, FAIR, are shown below to illustrate their nature and type. Examples of priority levels A and B in this condition are not available. Priorities at the lower end of the scale, C and D, are chosen to illustrate the type of maintenance just managing to be included in the maintenance audit survey.

Scuffed Walls

Typical corridor with scuff marks, minor scratches, etc. Functionality not compromised. Repairs are not urgent.

Condition = FAIR
Priority = C/D



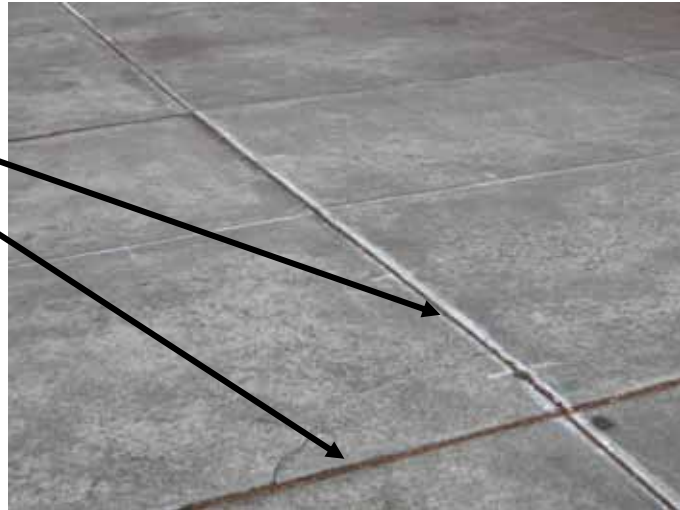
ARTICLE FOR STRUCTURAL SURVEY

Paved Areas

Minor differential settlement less than 5mm. Minor tripping hazard.

Condition = FAIR

Priority = C



Room Air Conditioner

Check physical condition of the unit for damaged fins, rust and support brackets. Also check externally for damage to fascia, controls, etc and if any damage internally.

In this unit the fins need combing out. Will have a minor effect on the functionality of the room.

Condition = FAIR

Priority = D



COSTING MAINTENANCE

Costs for maintenance work identified by the audit are automatically costed by the Physical Resource Management System (PRMS). A schedule of rates assesses the costs of repair, rectification or replacement works for all the common maintenance items. These costs have been assessed on a consistent basis by a firm of professional quantity surveyors and these estimates have been integrated into the software.

In most situations the auditor will not override the standard costs in the system unless the auditor is confident that a rectification item identified would be *clearly outside* the standard allowance and the *cost difference would be expected to be significant*. This option is available and is shown in column 5 of Figure 3.

The build up of maintenance costs have assumed the following conditions that make the costs quite different to new building work of the same kind:

- Small quantities;
- Isolated activities;

ARTICLE FOR STRUCTURAL SURVEY

- No benefits for larger quantities or multiple similar activities;
- Elements and sub-elements are replaced with equivalent items (no upgrade or improvement in quality);
- Standard materials are used in all cases;
- Rectification restores an item back to its original state, including all making good and painting;
- Standard metropolitan rates are applied generally with the need to allow for regional allowances where appropriate.

Thus, at the end of the audit the system can provide detailed costings of each maintenance item within a school and integrated costings for the whole state broken down into elements and condition, priority classifications and other categories, if necessary.

RESULTS

After the audit was completed in late 2005 the Department was able to use the audit results in the Department in its *Physical Resource Management System (PRMS): Maintenance Assessment Guidelines* (DET, 2005), which was fully integrated with School Asset Management System (SAMS) and the standard costings to provide data, statistics and detailed cost analyses based on the following major variables or criteria:

- All Building elements
- Condition (Poor, Worn, Fair) and priority (A,B, C, D)
- Planned and Unplanned/Ineligible
- Specialist work (generally where an engineer's report or specialist review was needed).

These two processes and systems show a depth of integration that have enabled the Department of Education and Training to commence the significant process of identifying schools and elements of these buildings in the most urgent need of care and attention.

Whilst the audit data has allowed various and detailed analyses to be carried out, unfortunately these are too numerous to be included in this summary, which focuses on the process than the financial results.

Departmental analyses have focused on work in all the conditions and priorities noted earlier:

- Poor A, B, C and D
- Worn A, B, C and D
- Fair A, B, C and D

For the purposes of all the data analyses all unplanned and ineligible work has been separated within the Department. These works generally include spaces, buildings and rooms that are the responsibility of the school and other facilities that lie outside the Department's budgets. In this way the audit has permitted the Department to focus on the maintenance that really matters to school operations and the provision of safe and adequate facilities.

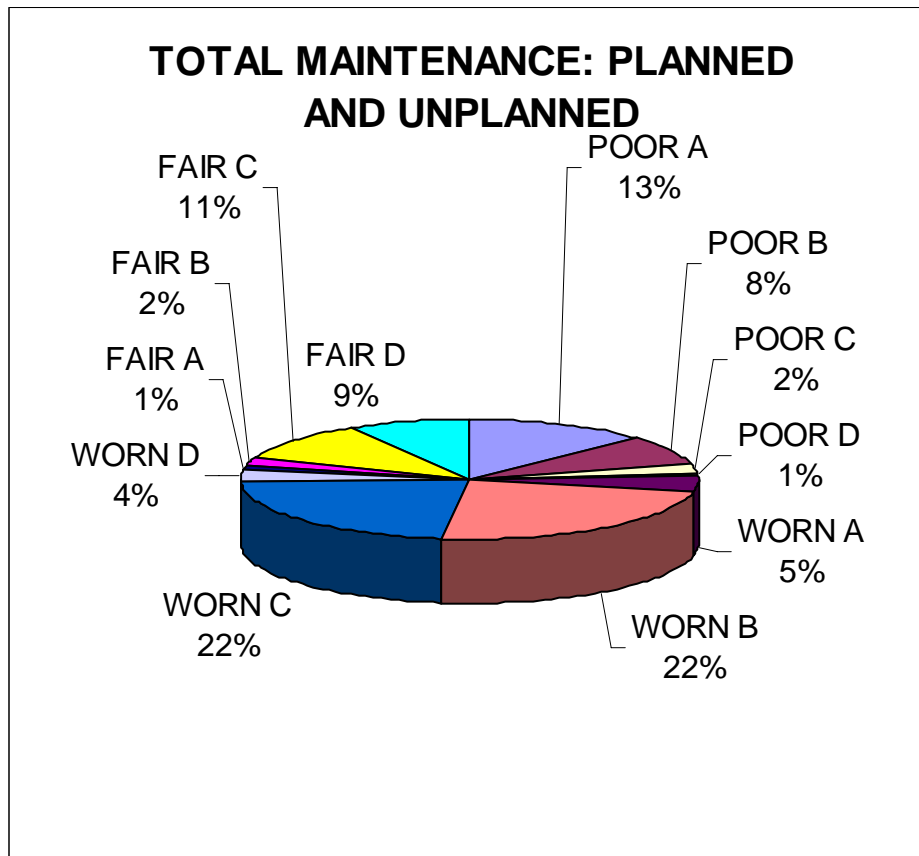
The percentages of maintenance work in each category (planned and unplanned) of maintenance works are shown in Figure 4 below. Unfortunately, actual values of maintenance

ARTICLE FOR STRUCTURAL SURVEY

work in each category, condition and priority cannot be included in this article as they are confidential.

ARTICLE FOR STRUCTURAL SURVEY

Figure 4 Planned and Unplanned Maintenance



Note that for the purposes of audit analysis and budgetary requirements any maintenance work at Worn D category and below was automatically designated 'unplanned' as it was less critical than the maintenance items in the Poor and Worn A to C categories above this threshold. A small amount of unplanned work is also contained in the more urgent categories of Poor A, B, C and D and Worn A, B and C, but unplanned work represents a small proportion of the total work in these categories. This work is mainly to buildings that are excess to needs of the school and have been retained despite enrolment numbers falling to levels where the school can no longer justify their retention. In most cases the school would fund the maintenance in these buildings from its own sources and through the community especially where these buildings are being used by groups outside or associated with the school.

In terms of the overall maintenance totals the categories with the highest percentages measured in the whole system (planned and unplanned) shown in Figure 4 are 'Worn B' with 22% and 'Worn C' with 22% of the total. Taken together these two categories represent nearly 50% of the total maintenance items. The next largest category is 'Poor A' with 13% and since this is the maintenance needing the most urgent attention this should and has received early funding to carry out the rectification of these items. In fact, the two highest categories of Poor A and Poor B, show over 20% of the total cost of the maintenance works requiring attention.

Interestingly, the maintenance items at the lower end of the categories, that is Worn d (4%), Fair A (1%), Fair B (2%), Fair C (11%) and Fair D (9%) amount to 27% of the total maintenance. Whilst they do not urgently require attention they show the build up of future

ARTICLE FOR STRUCTURAL SURVEY

maintenance and if they receive insufficient attention then over time these categories will move inexorably into the more urgent categories over time. They provide the Department with an early warning system of maintenance to come and to make financial provision for such items in future budgets.

CONCLUSION

The audit software incorporating data from the *Physical Resource Management System (PRMS) Maintenance Assessment Guideline* and the School Asset Management System (SAMS) represents best practice in property and asset management systems and leads its counterparts in other Australian states. The audit is not just a maintenance data collection process it is a fully integrated system of property and asset management. The maintenance audit also updated of the school property records through the system of e-plans and other physical data by the inspectors and being linked to the School Asset Management System (SAMS). Each school's set of physical records was kept up to date by these integrated systems. Thus, the process of conducting the maintenance audit has resulted in the most comprehensive review and updating of all the maintenance requirements in school buildings. It has provided real and accurate costing of this work on a fair, methodical and consistent basis. The size of the final costs in each category have allowed funding to be refined, targeted and focused on many key and important areas.

The process of auditing has also significantly reinforced the progression towards devolving responsibilities for maintenance work on school buildings closer to where the decisions on these matters are best carried out. That is, to the state regional educational offices and more importantly, to the schools themselves.

The cost audit data collected in the 2005 survey also provided the basis for a number of financial scenarios to be explored by the Department in tackling the full scope of maintenance in schools in Victoria. The definition of maintenance into the three conditions of severity; poor, worn and fair allowed the consideration of work in these conditions to be costed, compared and allocated a priority. Scenarios also identified the cost of clearing critical elements within an important grouping. For instance, sealing the building envelope through the rectification of the envelope elements contained in the roof, external walls, external doors and windows were modeled. This approach would allow schools to positively check deterioration of many key external elements and internal elements adversely affected by weather penetration. Similarly, key areas internally such as 'wet areas' and particularly toilet areas were identified through the collection of costs in the elements of sanitary fixtures, sanitary plumbing and external sewer drainage.

The audit resulted in a substantial increase in the annual maintenance budget. The audit results provided real data for these decisions to be made and these additional funds (amounting to A\$50 million) were directed to the now clearly identified Poor and Worn category maintenance items. Targeted funds (of A\$16 million in value) were also directed specifically to these areas and to those concerned with toilets to overcome any severe maintenance problems.

The audit has resulted in an increase in funding for maintenance in schools, but the costings have also confirmed the fact that there is an ongoing backlog of maintenance work that needs urgent attention. The political and administrative environment for this work has been given a focus and the Schools Resources Division in the DET is actively working on funding plans and arrangements to rapidly overcome these identified maintenance problems over the next few years.

ARTICLE FOR STRUCTURAL SURVEY

Acknowledgment

The *Maintenance Assessment Guidelines* (DET, 2005) were developed by Sinclair Knight Merz (SKM), Melbourne in conjunction with the Department of Education and Training of Victoria and the authors would like to thank SKM for their kind permission to use material from these guidelines including the photographs taken from that document in this article.

References

Australian Institute of Quantity Surveyors (AIQS) (2000) *Australian Cost Management Manual*, AIQS, Canberra.

Ferry, D J; Brandon, P S and Ferry, J D (1999), *Cost Planning of Buildings*, 7th edition, Blackwell Science, Oxford.

Flanagan, R and Tate, B (1997), *Cost Control in Building Design*, Blackwell Science, Oxford.

Department of Education and Training (DET), Victoria (August 2005) *Physical Resource Management System (PRMS) Maintenance Assessment Guidelines*,

Smith, J and Jaggar, D (2006) *Building Design Cost Planning for the Design Team*, 2nd edition, Elsevier, Oxford.

ARTICLE FOR STRUCTURAL SURVEY

Figure 3 The Auditing Process on Site

