

**Victorian Electoral  
Commission**

**REVIEW OF BALLOT COUNTING SOFTWARE**

**BMM Australia Pty Ltd**

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## Executive Summary

The Victorian Electoral Commission requested a review of new software to be used for counting first-past-the-post, proportional representation and preferential voting ballots and also a review of ballot draw software.

The scope of the review included:

- A review of VEC analysis documents to ensure they correctly define the requirements for the calculation of proportional representation;
- A review of testing methodology, test cases and test results;
- Inspection of source code for any fraudulent code and to ensure it accurately implements the requirements;
- A review of the random number generator used for computer ballot draws; and
- Confirmation and certification that the code correctly implements the calculation of proportional representation in accordance with the relevant legislation.

BMM found that

- a) The quality assurance methodology and software quality control was rigorous and well documented;
- b) The use cases upon which software development and testing were based were adequate to ensure that the system complies with relevant legislation;
- c) The system had been tested to ensure that previous election counts could be reproduced with the same candidates being elected at the same stages of the count;
- d) There was no malicious code in the software; and
- e) The random number generator software performs a fair ballot draw.

BMM concludes that the new EMS counting and ballot draw software performs correctly and complies with relevant legislation.

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# 1 INTRODUCTION

The Victorian Electoral Commission (VEC) requested BMM to perform a review of new software to be used for counting first-past-the-post, proportional representation and preferential voting ballots and also a review of ballot draw software.

The scope of the evaluation was defined as:

- A review of analysis documents to ensure they correctly define the requirements for the calculation of proportional representation;
- A review of testing methodology, test cases and test results;
- Inspection of source code for any fraudulent code and to ensure it accurately implements the requirements;
- A review of the random number generator used for computer ballot draws; and
- Confirmation and certification that the code correctly implements the calculation of proportional representation in accordance with the relevant legislation.

VEC provided access to the source code and to expert personnel in business, development and quality assurance.

Also the following documentation was provided:

- *EMS Re-Development Project Use Case Development – Computer Count Module – Calculate; and*
- *EMS Re-Development Project Software Quality Assurance Plan – Turing*

The relevant legislation that defines the counting processes is:

- *Schedule 3 of the Local Government Act 1989 as amended to 13 September 2005,*
- *Electoral Legislation (Further Amendment) 2005, clauses 21(2) and 21(3).*

## 2 EMS SOFTWARE

The Election Management System (EMS) software is being re-developed using Silverlight for the client interface with the core functionality provided by services called from the interface.

The counting software is written using a combination C# workflows and regular C# source code. The workflows implement the overall logic as defined in legislation with the mechanics of counting and database accesses mainly provided by the underlying source code.

The main sources examined were:

CalculateBL.cs	counts ballots and distributes preferences
RandomHelper.cs	used for ballot draws and for tie resolution
CalculateFPP.xamlx	first-past-the-post work flow
CalculatePR. xamlx	proportional representation work flow
CalculatePref. xamlx	preferential voting work flow

BMM found that

- the workflows and other sources correctly implement the logic defined by legislation;
- the random number generator is used correctly in the cases where a “draw by lot” is required; and
- there is no malicious code in the software.

The software was clearly structured and quite well commented. One improvement would be for additional comments in the C# source to clearly show which methods are called from each of the three workflows.

## 3 QUALITY ASSURANCE

VEC employs an “agile” approach for development and testing. This approach provides iterative cycles and quality gates that ensure that business use cases are correctly implemented by software

development, subjected to multi-level testing and formal acceptance before final deployment. The system provides ample documentation to allow audit of the process.

## **4 USE CASES AND TEST RESULTS**

BMM reviewed use cases defined for the counting sub-system. However it is the case that the legislation provides the primary definition of how counts and preference distributions are to be performed.

BMM verified that the software does implement counting as defined in legislation and in the defined use cases.

VEC also provided test results that proved that the new software can reproduce the results of prior elections with the same candidates being elected at the same stages of the count.

## **5 CONCLUSION**

BMM found that

- a) The quality assurance methodology and software quality control was rigorous and well documented;
- b) The use cases upon which software development and testing were based were adequate to ensure that the system complies with relevant legislation;
- c) The system had been tested to ensure that previous election counts could be reproduced with the same candidates being elected at the same stages of the count;
- d) There was no malicious code in the software; and
- e) The random number generator software performs a fair ballot draw.

BMM concludes that the new EMS counting and ballot draw software performs correctly and complies with relevant legislation.