

# S O L G M

NZ SOCIETY OF LOCAL GOVERNMENT MANAGERS



## **VOTE PROCESSING AND COUNTING ASSURANCE**

**Guidelines for achieving assurance on vote  
processing and counting in local elections  
and polls**

### **Appendix C Part 14**

**Code of Good Practice  
For the Management of Local Authority  
Elections and Polls**

Produced by the  
SOLGM Electoral Working Party

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# Purpose of this document

This document addresses particular election management issues arising from the inquiry into the 2004 local authority elections conducted by the Justice and Electoral Committee (JEC). These issues fall into the category of *vote processing and counting*.

In response to the JEC's report, the SOLGM Electoral Working Party (EWP) has developed these guidelines to provide a framework for *end-to-end assurance* on the sequence of vote processing and counting stages in New Zealand local authority elections and polls.

The objective of the EWP, in producing these guidelines, is to assist electoral officers to meet the expectations of both their local authority and the public that local elections and polls are conducted in a manner that produces accurate and timely results. This applies whether the election or poll is conducted in-house by the electoral officer or is contracted to an election service provider.

To help achieve this objective, the EWP recommends that the electoral officer satisfies him or herself that the information technology tools and business processes used in any election or poll are well documented, independently tested and *fit for purpose*.

## Issues addressed

These guidelines address, wholly or in part, the following recommendations by the JEC:

**Further consideration be given to the most appropriate method of providing the required assurance around vote processing and counting systems including the need/practicality of 'end-to-end' certification.**

Much of these guidelines are concerned with determining the fitness for purpose of software components and business processes to achieve 'end-to-end' assurance. This is recommended as an alternative to certification.

**A complete 'end-to-end' counting process should be formally documented.**

These guidelines address this issue on two levels. Firstly, they provide a breakdown of typical 'end-to-end' counting processes for both first past the post (FPP) and single transferable voting (STV) elections. Definition of an 'end-to-end' counting process is necessarily generic. The detail in the process depends upon the software system used to implement the steps in that process and also upon the business processes adopted by the electoral officer. The reason for including the generic descriptions is to ensure both electoral officers and other interested parties understand the nature and elements of the 'end-to-end' counting process.

Secondly, it is essential for electoral officers that their particular 'end-to-end' system is documented in appropriate detail. This includes documentation for any software package provided to them to ensure the package is correctly used. There must also be documentation of steps that are not implemented by software components and their associated controls.

**Electoral officers should have a good understanding of the contractor's approach, understand the key steps and controls within that approach, and consider the need, nature and extent of pre-count verification of the system and controls.**

These guidelines strongly support this recommendation. The electoral officer remains accountable for the proper conduct of an election or poll whether or not all or part of the election process is contracted out. To assist the electoral officer to have confidence in the electoral outcomes, the

electoral officer needs to have a full understanding of any contractor's systems and processes. A recommendation relating to the appointment of an independent auditor is designed to help achieve the required confidence.

**All parties should adhere to applicable codes of “best practice” for developing and operating in an information systems environment.**

The EWP strongly recommends the adoption of these good practice guidelines by electoral officers and other parties involved in the conduct of local elections.

## Definitions

### Assurance

These guidelines use *assurance* in its general meaning of seeking to ensure or make certain a particular outcome. In the context of local authority elections and polls, this outcome is production of accurate and timely results. The outcome relates to both business processes and information systems employed at a particular election or poll and is achieved through independent testing of processes and systems, and full documentation including training material, reports and business process definitions to support the successful outcome of the election.

### Audit

These guidelines use the term *audit* to mean the subjecting of all information technology (IT) applications and all automated and manual procedures to independent examination to confirm that they have been defined and implemented appropriately to perform their required tasks without error or to enable identification of any error or fault when it may occur. Appropriate levels of sample testing are required to support an audit report. An *audit* would not normally involve the detailed examination of software components, but rather provide an assurance that all software components have been independently tested within the defined limits in which they are to be used.

### Certification

These guidelines use the term *certification* to mean the subjecting of a component of a software package, or the whole package, to independent examination of the design of the package and exhaustive testing to confirm desirable behaviour and identify any abnormal behaviour or unexpected faults in any environment. Certification requires absolute levels of evidence typically through full-scale 100 percent sample testing. It would normally be undertaken by a company with expertise in testing software systems. Certification is often used in a broader audit sense, but its use in these guidelines is restricted to the narrower meaning identified here.

### Election or poll

Any reference in this document to an *election* is also intended to include a *poll* unless the context precludes it. Elections and polls cover both FPP and STV.

## End-to-end

The EWP has, for the purpose of identifying boundaries for vote processing and counting assurance, defined 'end-to-end' as from the receipt of voting documents from voters to the production of election results. The generic steps involved in 'end-to-end' processing and counting for both FPP and STV elections are set out in Appendix A.

## Fit for purpose

Fit for purpose is an expression that is used to describe the basic expectations of a business process or information system solution and its appropriateness for an organisation.

To be fit for the purpose of running a local authority election in New Zealand, the business processes adopted by an electoral officer, or a service provider, must meet legislative requirements, and should meet any code of practice or other mechanism for electoral guidance. Other industry expectations and generally accepted good practice should also be considered when determining the fitness for purpose of electoral processes.

In respect of information systems, either provided by a vendor or developed in-house, fit for purpose means the IT system supporting the business processes is precisely appropriate for the purposes intended. For local authority elections, the system must be able to capture and process voting documents in accordance with process requirements. It must also provide adequate system controls to maintain voting document integrity and provide sufficient information to support the electoral officer in discharging his/her electoral duties.

Assurance on an IT system can be obtained either through independent certification of the software or by reliance on independently supervised testing that the system is fit for purpose in the particular environment in which it is to be used. In the context of local authority elections in New Zealand, the EWP believes it is appropriate to rely on fit for purpose testing of the system in a particular environment.

## System

Wherever used in these guidelines, the word system is used in a general sense, not in reference to a piece or a package of software. A system includes the software and associated processes. The business processes that take returned voting documents right through to the results of an election are necessary parts of the electoral system.

## Dealing with split responsibilities

These guidelines make no specific distinction between an election conducted completely in-house by an electoral officer and one conducted completely or in part by an election service provider. Each electoral officer will need to consider the application of these guidelines and in particular detailed documentation to reflect the actual arrangements for his/her election.

For example, the required scrutiny may be performed by an electoral officer who subsequently transfers batches of voting documents to an election service provider for processing. In such a case, it will be necessary for the service provider to establish processes and control points that enable reconciliation of the voting documents across the electoral officer – service provider boundary.

Another circumstance to be addressed is where an electoral officer or service provider processes

some voting documents and then transfers this data electronically to another electoral officer or service provider for completion of the processing and counting for the issue concerned.

In general terms, partial processing at different locations require special control points and reconciliation to provide assurance that voting documents are not lost or overlooked. In this type of scenario, 'end-to end' reconciliation that encompasses all transfer boundaries becomes even more important.

## Contingency planning

These guidelines focus on normal vote processing and counting processes within the 'end-to-end' system as defined above. The assurance steps identified in these guidelines are designed to ensure this can proceed smoothly and to mitigate risks of problems in vote processing. All risks, however, cannot be entirely eliminated and electoral officers still require appropriate contingency planning and disaster recovery plans.

Part 14 of The Code of Good Practice for the Management of Local Authority Elections and Polls gives examples of the things that can go wrong at election time and the need for good risk management strategies to address these. The EWP strongly recommends that electoral officers, in association with any election service provider, develop such strategies in addition to adopting these guidelines.

## Assurance: Information technology systems

Assurance on IT systems can be sought at different levels.

### Previous usage

An electoral officer may have had previous experience with an IT system and plan to use this system again in the same way at the next election substantially unchanged. The EWP believes, even in these circumstances, that it is desirable for the electoral officer to be able to demonstrate to his or her local authority and, if necessary, the public that the system is fit for purpose. It believes the most effective way to achieve this is for the electoral officer to submit a fit for purpose certificate to the local authority. This certificate would be provided by an independent party (e.g. auditor) who has confirmed the system is able to capture and process all voting documents in accordance with documented rules, procedures and timeframes. This documentation will also provide comfort that, in the event of the absence of the electoral officer, other less experienced persons can ensure that vote processing can continue unaffected.

### Fit for purpose testing

If an electoral officer or his or her contracted service provider is using a new IT system or one that is substantially modified, then the electoral officer will need to be satisfied on the full range of functionality required to run the election. The EWP believes that the assistance of an experienced auditor is necessary to achieve this level of satisfaction. It is envisaged that the auditor and electoral officer would, among other things, agree on the nature and appropriate levels of system testing. The outcome must be that the system, and accompanying documentation, fully supports the running of the election and provides all the required controls to ensure accurate and timely election results in accordance with all statutory and good practice requirements. Assurance would include:

- when the IT system is applied to the actual election, it will handle the full amount of data and run at a satisfactory speed to ensure timely and accurate election results;
- the IT system provides adequate system controls to maintain voting document integrity and provides sufficient information to support the electoral officer in discharging his/her electoral duties; and
- the processes that will be used to operate and support the IT system are appropriate, adequately documented and well understood.

Appendix B identifies detailed features expected to be included in fit for purpose software testing.

The EWP recommends that the auditor be requested to provide a fit for purpose certificate for the IT system to be used at the upcoming election and that the electoral officer submits a copy of this certificate to his/her local authority.

## Independent certification

Certification goes beyond fit for purpose testing and proves the robustness of the IT system by more exhaustive testing including in a different (replica) environment. The certifier conducts full-scale tests on both desirable and abnormal behaviour of the system and unexpected faults. The certifier would verify all aspects of the system design as well as how the system handles unexpected events and usage. If the system includes complex algorithms, such as within the STV Calculator, certification provides sector assurance over a system function that may be costly to test individually.

Certification provides the highest level of system assurance. The EWP does not believe that this is necessary, as distinct from fit for purpose testing, and is unsure whether the necessary expertise is readily available to carry it out for the 2007 local elections.

## Assurance: Business processes

Assurance on non-software manual business processes also needs to meet the fit for purpose test. This includes full documentation of these processes, procedures and training to ensure all electoral officials are fully conversant with these procedures.

The EWP believes that all electoral officers should consider the engagement of an independent auditor to provide assurance that the necessary business process documentation is in place. The focus of the professional audit assistance would be on all aspects of the electoral officer's 'end-to-end' processes and systems that have not already been subject to independent testing. The final scope of the independent audit would be agreed between the electoral officer and the auditor. Appendix C addresses the recommended standard of audits.

Recommended good practice is that the electoral officer submits to his/her local authority a copy of the auditor's report on the 'end-to-end' systems and processes to be used at the election.

Electoral officers will be aware of the general nature of recommended good practice in this area from early drafts of these guidelines. The EWP is aware, however, that it may not be practical (including necessary budget provision) for all electoral officers to engage auditors at this stage in the lead-up to the October 2007 local elections. In recognition of this, an offer has been made by the New Plymouth District electoral officer to share his audited business processes and procedures with other electoral officers. The EWP accepts this would be a pragmatic approach to ensure a level of confidence on the necessary business processes. It notes, however, that such a course of action is short of the recommended fit for purpose standard.

# Recommended good practice

For the purpose of achieving assurance around end-to-end vote processing and counting at local authority elections, the EWP recommends the following good practice:

1. the electoral officer ensures he or she has a detailed understanding of the 'end-to-end' vote processing and counting system that is to be used for the election(s) for which he or she is responsible including where responsibilities for vote processing may be split between different parties, and the system is fully documented;
2. the electoral officer uses, or contracts an election service provider to use, an IT system that has been proven to be *fit for purpose* as follows:
  - a. if the IT system is supplied by a vendor or has been developed in-house, the electoral officer is provided with a certificate from an independent auditor confirming that the system has been tested and meets all the requirements for that election including being able to handle the required data volumes at the required speed;
  - b. if the electoral officer contracts an election service provider to process and count votes, the electoral officer is provided with a certificate from an independent auditor confirming that the IT system to be used has been independently tested and meets all the requirements for that election including being able to handle the required data volumes at the required speed;
3. the electoral officer ensures all other vote processing and counting activities (outside the IT system) are fully documented and the appropriate electoral officials are properly trained and conversant with these business processes and procedures, and:

**EITHER**

  - a. for the purpose of ensuring these processes and procedures are *fit for purpose*, engage an independent auditor to provide a report for this purpose;

**OR**

  - b. adopt processes and procedures audited for another electoral officer;
4. the electoral officer submits to his or her local authority (for all territorial authorities, regional councils, district health boards and licensing trusts) a copy of the independent auditor's IT system fit for purpose certificate and business processes audit report along with confirmation of the particular IT system and business processes to be used at the upcoming election.

## Vote processing and counting steps

In general, the steps defined below represent a continuous flow of manual and automated processes through which each batch of returned voting documents proceed. Most steps are simultaneously executing (on different batches) at any time during the vote processing stage of the election.

### The CobiT control model

The EWP adopts the view, as described in detail in CobiT 4.0<sup>1</sup>, that the existence and use of controls associated with all IT components and business processes is vital to the production of an accurate result.

CobiT 4.0 (pp 12-13) categorises IT resources into the following four groups:

- **applications:** the automated user systems and manual procedures that process the information;
- **information:** the data in all their forms input, processed and output by the information systems, in whatever form is used by the business;
- **infrastructure:** the technology and facilities (hardware, operating systems, database management systems, networking, multimedia etc, and the environment that houses and supports them) that enable the processing of the applications;
- **people:** the personnel required to plan, organise, acquire, implement, deliver, support, monitor and evaluate the information systems and services. They may be internal, outsourced or contracted as required.

While it is clear that each of the four groups of resources is vital to the successful outcome of an election or poll, it is the applications, together with their automated and manual procedures that need to be independently tested as fit for purpose.

As covered by CoBiT 4.0, the successful outcome of an election or poll relies on the information (voting documents), processed by the applications running on the infrastructure, operated by the people.

Translating this principle to an election system, we need definitive, measurable process control points to determine whether all voting documents, votes and preferences are included in the processing and they are accurately interpreted and processed by the applications, and that each step is tamper free. For example, we know how many batches of voting documents per 'combination' are created, so at each step of the processing chain, a match can be made to determine that all known batches are dealt with. The measurable processing steps include roll scrutiny, extracting, vote recording (by hand wand, data entry, full page scanning), vote capture for the first time, second vote capture (for checking) followed by reconciliation. Only then will the electoral officer have confidence that the results include all known batches of votes. This would identify at each stage of the processing any batches of votes 'missing' or unaccounted for.

Apart from software applications, the infrastructure and the people resources in an overall system are also capable of failure. Where possible, an audit must consider these other resources and the likelihood and impact of their failure on the vote process.

In summary, in an election system, a very important part of this end-to-end assurance is that voting documents, either individually or in batches, are seen to be processed through all the required steps by all of the component applications and manual processes in sequence.

<sup>1</sup> Control Objectives for Information and related Technology (CobiT®), IT Governance Institute, [www.itgi.org](http://www.itgi.org)

## Checking systems

The Local Electoral Act and the Local Electoral Regulations require the use of checking systems to provide assurance that each step in the processing and counting of votes and preferences:

- includes all the validly cast votes and preferences; and
- is undertaken accurately.

The Local Electoral Regulations provide in clause 79(b) for FPP elections...

### **79B Performance standard for checking systems.**

- (1) The checking system must ensure that the results of the determination specified in regulation 79(3) are as least as accurate as those that would be produced by...**
  - (a) carrying out the following operations manually -**
    - (i) rejecting blank voting documents and informal voting documents;**
    - (ii) counting votes from valid voting documents; and**
  - (b) repeating the operations in paragraph (a); and**
  - (c) resolving any discrepancies.**
- (2) In determining whether or not the performance standard in subclause (1) is met, it is sufficient to make reasonable inferences about the errors that are likely to be generated by the operations specified in subclause (1)(a).**

Further, the Local Electoral Regulations provide in clause 104(a) for STV elections:

### **104A Performance standard for checking systems.**

- (1) The checking system must ensure that the preferences recorded under regulation 101 or regulation 102 are as least as accurate as those that would be recorded by...**
  - (a) carrying out the following operations manually -**
    - (i) rejecting blank voting documents and informal voting documents;**
    - (ii) recording votes from valid voting documents; and**
  - (b) repeating the operations in paragraph (a); and**
  - (c) resolving any discrepancies.**
- (2) In determining whether or not the performance standard in subclause (1) is met, it is sufficient to make reasonable inferences about the errors that are likely to be generated by the operations specified in subclause (1)(a).**

The legislation does not prescribe how the checking is to occur, leaving it to the electoral officer to ensure that appropriate and adequate checking mechanisms exist and are used.

Common points of failure include:

- a human interpreting data from a voting document and entering it into a computer; and
- software automatically processing scanned images of voting documents into votes and preferences.

For these points of potential failure, an electoral officer or service provider must ensure that:

- all human interpretation and data entry is checked at least once by another person. This is normally done by repeated data entry and automated comparison of the two data streams

- followed by manual data repair where a difference is detected;
- reporting is available that shows the number of differences detected, and the number of corrections; and
  - there is a manual process to check that the automated interpretation of votes and preferences includes all validly cast votes and preferences, and produces the correct data.

The auditing of an election system must determine that reasonable processes are defined to provide assurance that all validly cast votes and preferences are correctly presented to and processed by the counting software or to the STV calculator, and that an audit trail exists to demonstrate to third parties, or other interested parties, that the data has been correctly processed.

It is the view of the EWP that good practice requires a checking system at any point in an election system to include all of the voting documents, their votes and preferences. A checking system based on random sampling is not sufficient.

## Examples of checking systems

Here are three examples of checking procedures that are typical in running an election:

- two operators independently wand or key votes or preferences from a voting document. The entered data is compared by software and where there is a difference detected, a third person reconciles the difference;
- a voting document is scanned (with a page scanner) and votes or preferences are recognised by software. A person then checks the voting document against the data stored in the computer database. Differences are resolved and the edits checked by another person;
- a computer application produces a report listing all the batches of voting documents that have undergone the initial scrutiny but have not been included in the final results. The batches are located and processed to completion.

It must be stressed that when votes are processed manually, all votes must be processed twice by different persons. This was previously known as the preliminary and official counts. Now the second processing is referred to as the checking system. The results of the two processing streams must be reconciled to ensure accuracy and completeness of the results. For hand-wanding and keyboard data entry, the data must be input twice in separate streams, and then reconciled. For full-page scanning, only one image need be taken, but the image must be processed twice and the votes reconciled. EWP believes that this fulfils the legal checking requirement.

## System segmentation

In very simple terms, what the CobiT control model says is that systems can be segmented into processing steps that can be separately verified in operation by comparing the actual outputs to the expected outputs. If each step is shown to be operating correctly, then we can be assured that the whole system is correct from start to finish.

From an auditing perspective, it is also important that outputs from the final step can be reconciled with inputs from a suitable point at the start of the overall process to ensure that no data (voting documents or batches of voting documents) has been lost along the way, between processing steps.

This part of the document illustrates the segmentation of an end-to-end process for local

authority elections. Although they contain some common steps, FPP and STV issue processing is presented separately for clarity.

It is most important to understand that the steps or stages defined in the diagrams below are not necessarily the way that any particular election software suite might break down into its component applications and manual processes. However, given that the legislation identifies some broad steps of in the conduct of an election, we might expect that the breakdown presented below is broadly accurate for the conduct of any election.

In practice, a particular voting document will normally contain some FPP issues and at least one STV issue (for the district health board). Therefore a batch of similar voting documents will provide data that feeds into both FPP vote totalling and STV preference allocation steps. How this is done will vary in the fine detail between different systems.

## Vote processing for an FPP issue

Processing an FPP issue consists of a sequence of the following broad steps:

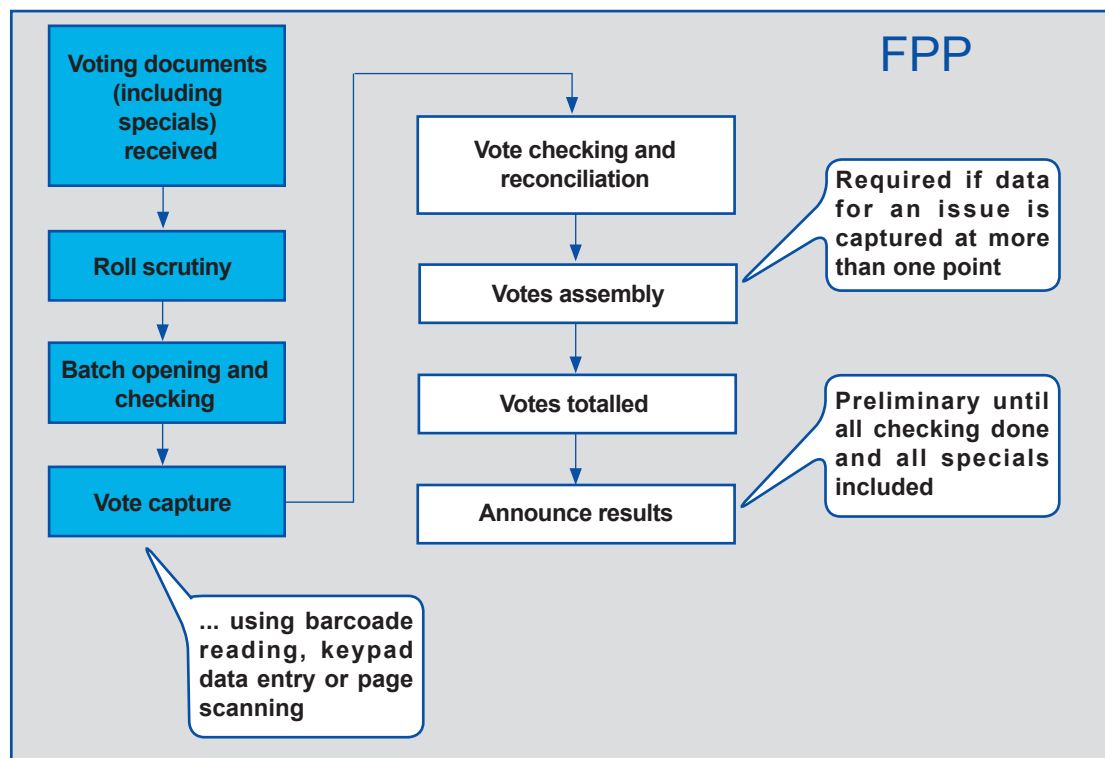


Figure 1: A typical FPP issue processing sequence of steps

- 1. Roll scrutiny:** Returned voting documents are sorted and batched according to “combinations” of issues. The elector numbers are entered into the database and recorded as being a member of the particular batch. This means all like voting documents are processed together. Sorting prior to processing is considered essential, so that all like issues can then be identified and easily managed for example in a judicial recount or inquiry. This step has the following input and outputs...

**Inputs:** Individual returned voting documents in the unopened envelopes.

**Outputs:** Batches of unopened envelopes sorted into specific combinations, each batch with a unique batch ID number and a list of electors who have voted.

- 2. Batch opening and checking:** Envelopes in a batch are opened then the voting documents are checked and made ready for vote capture. Anomalies such as finding more than one voting document in one envelope are dealt with. Voting documents with problems that will affect vote capture are identified and dealt with. This step is entirely manual. No computer-related processes are required. Note that this is the beginning of the control process in terms of recording the number of documents in each batch and recording anomalies/problems so they can be resolved and processed.

**Inputs:** Batches of unopened envelopes with header sheets, sorted into specific combinations.

**Outputs:** Secured bundles of voting documents with header sheets, ready for data capture. Control totals (the number of voting documents in the batch) and any other control information will be included on the batch header sheet.

- 3. Vote capture:** Each batch is put through a data capture process. The votes marked on the voting documents are recorded in a database. If the data capture is a significantly manual process such as wanding barcodes, the data capture is repeated and both streams of data are presented to the data checking process (see below) for comparison. Note that there must be a checking process in place to ensure that all votes are captured correctly and an audit trail is available.

**Inputs:** Secured bundles of voting documents with header sheets, ready for data capture.

**Outputs:** Batch details and data in a database.

- 4. Vote checking & reconciling the differences:** The captured data is checked, and where there is any difference between the two data streams, the original voting document is checked. Correct data is entered into the database. Inconsistencies and their resolution are recorded in an audit trail.

**Inputs:** Data from voting documents that a software test has determined could contain an error.

**Outputs:** Correct, verified data with an audit trail.

- 5. Votes assembly:** When data is for (some) regional councils and licensing trusts and is being provided from a number of sources, the data streams must be amalgamated before results are totalled.

**Input:** Vote data received from various data capture systems.

**Outputs:** All vote data ready for totalling.

- 6. Votes totalled:** The computer system adds up the votes and reports the results.

**Inputs:** Votes in the database.

**Outputs:** Election result reports.

## Preference processing for an STV issue

Processing an STV issue consists of a sequence of the following broad steps for STV issues. Note that some steps in an overall election system may be contracted out, but the responsibility for the overall system still remains with the electoral officer.

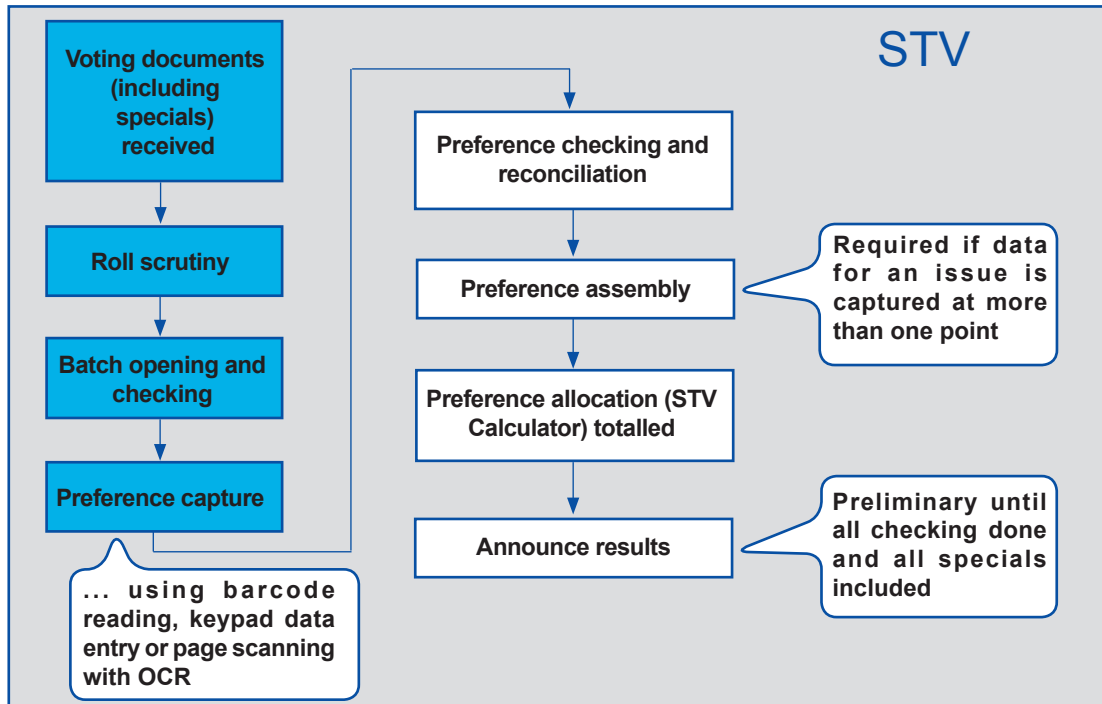


Figure 2: A typical STV issue processing sequence of steps

- 1. Roll scrutiny:** Returned voting documents are sorted and batched according to “combinations” of issues. The elector numbers are entered into the database and recorded as being a member of the particular batch. Sorting prior to processing is considered essential, so that all like issues can then be identified and easily managed for example in a judicial recount or inquiry. This step has the following input and outputs:

**Inputs:** Individual returned voting documents in the unopened envelopes.

**Outputs:** Batches of unopened envelopes sorted into specific combinations, each batch with a unique batch ID number and a list of electors who have voted.

- 2. Batch opening and checking:** Envelopes in a batch are opened then the voting documents are checked and made ready for vote capture. Anomalies such as finding more than one voting document in one envelope are dealt with. Voting documents with problems that will affect vote capture are identified and dealt with. This step is entirely manual. No computer-related processes are required. Note that this is the beginning of the control process in terms of recording the number of documents in each batch and recording anomalies/problems so they can be resolved and processed.

**Inputs:** Batches of unopened envelopes sorted into specific combinations with header sheets.

**Outputs:** Secured bundles of voting documents with header sheets, ready for data capture. Control totals (the number of voting documents in the batch) and any other control information will be included on the batch header sheet.

3. **Preference Capture:** The following steps describe wand or keyboard entry process.

**3(a) Preference capture by wand or keyboard entry:** Each batch is put through a data capture process which could be either by hand-wand or keyboard entry. The preferences marked on the voting documents are recorded in a database. If the data capture is a significantly manual process such as wand or keyboard entry, the data capture is repeated and both streams of data are presented to the data checking process for comparison.

**Inputs:** Secured bundles of voting documents with header sheets, ready for data capture.

**Outputs:** Batch details and data in a database.

**3(b) Preference checking & reconciling the differences of wand or keyboard-entered preference data:** The captured data is checked, and where there is any uncertainty, visually compared with the voting document. Correct data is entered into the database.

**Inputs:** Data from voting documents that a software test has determined could contain an error.

**Outputs:** Corrected numerical preference data.

Alternatively, Data capture may be by page scanning.

4. **Preference capture:** The following steps describe the page scanning process.

**4(a) Preference capture by page scanning:** Each voting document in a batch is scanned and an image generated. The image is held as a file or placed in a database.

**Inputs:** Secured bundles of voting documents with header sheets, ready for data capture.

**Outputs:** Images of scanned pages that will be subject to a character recognition process.

**4(b) Intelligent character recognition (ICR):** The preferences in the voting document images are interpreted by software. Possible errors or uncertainty are flagged for manual checking.

**Inputs:** Page images.

**Outputs:** Numerical preference data, some of which is flagged for checking.

**4(c) Preference checking & reconciling the differences in ICR data:** The captured data is checked, and where there is any uncertainty, visually compared with the voting document. Correct data is entered into the database. Inconsistencies and their resolution are recorded in an audit trail.

**Inputs:** Page images that are flagged for checking.

**Outputs:** Corrected numerical preference data with an audit trail.

5. **Preference assembly:** When data is for a district health board and is being provided

from a number of sources, the data streams must be amalgamated before results are calculated.

**Inputs:** Preference data received from various data capture systems.

**Outputs:** Amalgamated preference data ready for presentation to the STV Calculator.

- 6. Preference allocation:** The computer system invokes the STV Calculator (developed, certified and licensed by the Department of Internal Affairs) to calculate the results.

**Inputs:** Amalgamated preference data.

**Outputs:** Results in XML format.

- 7. STV results report.** The STV Calculator output is turned into a readable report.

**Inputs:** An XML-encoded results text file.

**Outputs:** A results report in plain English.

## What to look for in fit for purpose software testing

An electoral officer and an auditor will need to formally agree on the scope of fit for purpose IT system testing. The outcome would be a report on the adequacy of the processes and system documentation, functions, features, and test results. It would be expected that an IT system implements the following features and these must be adequately described by the accompanying documentation. The following list is not exhaustive but for guidance only:

- clearly defines how the end-to-end system is segmented into distinct applications and processes and what the purpose of each application and process is. This must include any steps that are entirely manual;
- adequate checking systems exist for every step and application used in the processing of voting documents;
- control points exist and reports are available from those control points and how the reports are intended to be used;
- the whole process allows any particular batch of data and its contained votes or preferences to be easily tracked, and its current state to be identified quickly;
- reports exist that describe how the status of each batch of voting documents and, where necessary, the location and status of any individual voting document can be determined;
- security features exist for confidentiality of voters, the votes and results, in accordance with the existing legislation, regulations and good practice;
- audit trails exist (normally files that list the details of an application's data processing) along with guidance on how they are activated and contents are to be interpreted, and mechanisms to protect against modification or tampering;
- the software environment in which the election software is warranted to operate correctly, including service packs and security patches and other software components like anti-virus or security agents;
- a suitable hardware environment is defined (eg, workstation and server sizes and speed) necessary to provide satisfactory throughput for elections of various sizes and to provide for redundancy, availability and integrity;
- describes how the software must be installed and configured within the specific required operating environment;
- provides adequate instructions and test data to permit the electoral officer to perform acceptance tests leading to assurance that the system has been configured and is operating correctly;
- describes how to set the security of the system;
- describes how to install and configure any third-party software components (including the operating systems and database software if this is relevant) that are required for the election software to operate, or alternatively, reference satisfactory documentation supplied with the third-party software;
- describes how the election software is to be configured with election-specific parameters (issues, candidates, electors etc);
- defines data volume limits within which the software is warranted to operate correctly. This is particularly important if a service provider intends to simultaneously process an election for more than one local authority on the same platform;
- describes how each module is to be operated in respect of accepting input data, and producing output data output;

- any software module that produces data to be transmitted to another location, does so in a way that labels the data unambiguously, and also produces an audit report and statistics in a form that can be transmitted with the data;
- describes the administration steps that must be taken to ensure the correct operation of each module and to demonstrate that the output and input data is in balance and accounted for;
- adequately describes the meaning of every possible error message and what to do in the event of error occurring;
- adequately describes the steps that must be taken to safeguard the integrity of the data during an election;
- describes the way changes to the processes, systems or data are managed;
- describes the escalation procedures in the event of system or process failures that may impact the election results, timeframe or reputation of the electoral officer;
- any other aspects of the documentation that are vital to a successful election outcome.
- adequately describes the steps that must be taken to safeguard the integrity of the data during an election;
- describes the way changes to the processes, systems or data are managed;
- describes the escalation procedures in the event of system or process failures that may impact the election results, timeframe or reputation of the electoral officer;
- any other aspects of the documentation that are vital to a successful election outcome.\

## Standard of audit

The New Zealand Institute of Chartered Accountants, through its Professional Practices Board, provides a comprehensive set of standards for audit and assurance. Further, the Institute has recently completed its public consultation on the proposal to adopt the International Standards of the International Auditing and Assurance Standards Board (IAASB), including International Standards on Auditing (ISAs), in New Zealand. This body of standards (especially the Agreed-Upon Procedures) represents the best practice in auditing and assurance that is available to guide an audit of an election system in New Zealand.

The Electoral Working party proposes that every audit of an election system for New Zealand is undertaken in full compliance with the current standards adopted by the Institute to ensure that the audit can be relied upon by the Office of the Controller and Auditor-General.

The diagram below is part of the diagram of the Professional Standards Framework of the Institute of Chartered Accountants of New Zealand.

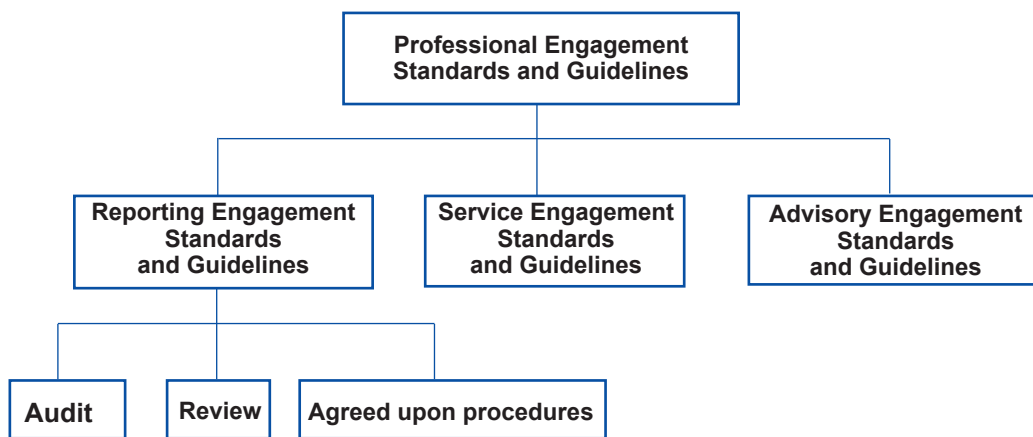


Figure 3: New Zealand Institute of Chartered Accountants professional engagement standards and guidelines