Introduction
The project to upgrade New Zealand’s banknotes was launched in 2011 to increase the level of security of the banknotes. Since the last upgrade in 1999, there have been considerable advances in banknote technology, and to stay ahead of counterfeiters, a review of the security elements was initiated. Central banks around the world typically upgrade their banknotes every seven to 10 years, and other countries currently upgrading their banknotes include Australia, the euro area, the United Kingdom, Switzerland, Norway, and Sweden.

Fortunately, counterfeiting is a relatively minor problem in New Zealand. During the past five years, annual rates have been below four fake notes per one million genuine notes in circulation. However, the risks have been growing steadily over time as counterfeiting technology becomes more sophisticated and affordable, increasing the potential gains from counterfeiting.

Additionally, the use of equipment that processes banknotes is growing in New Zealand, which increases the need for machine-readable security features to assist with the automated authentication of banknotes.

Periodic upgrades maintain confidence in the New Zealand currency, by ensuring that the banknote...
technology is up to date and ahead of the counterfeiters. At the same time, the Reserve Bank is taking the opportunity to reflect more of New Zealand’s bicultural heritage, while refreshing and modernising the look of the banknotes.

Because of the highly technical nature of designing and printing banknotes, and the resulting long lead times, planning started in 2011 for the new series. The Reserve Bank is intending to release the new notes progressively from 2015. The current series (sixth issue) will have been in circulation for 16 years by the time the new notes are issued. A survey in 2010 concluded that New Zealanders like the current themes (including portraits, flora and fauna) on the banknotes. The design scope did not therefore need to include a review of these but focussed on the upgrade of security alone.

This article describes the process of designing the next New Zealand banknote series, starting with the extensive analysis of requirements described in section 2. The steps in the design process are explained in section 3. Section 4 describes the new designs. Section 5 concludes and looks ahead.

2 Design requirements

The current banknote designs first appeared with the fifth issue in the early 1990s. Instead of all five denominations depicting the reigning monarch, four of the new designs included portraits of notable New Zealanders. The monarch remained on the $20 note. The other design items were selected carefully to create a coherent New Zealand design, including cultural elements such as tukutuku patterns for the first time.

The sixth issue, released in 1999, marked the switch from paper to polymer banknotes. The designs from the fifth issue were adapted to allow the inclusion of features unique to polymer banknotes, such as windows. The new banknotes will also be made of polymer.

Because the New Zealand public likes the current designs and the sole purpose is to upgrade the notes’ security, the Reserve Bank chose not to review the themes. Instead, the Reserve Bank limited the scope of the upgrade to a security review, and design improvements based on stakeholder feedback and other technological considerations. However, key design goals were to refresh the look of the notes while ensuring that they remained recognisable as New Zealand currency, and to better reflect the country’s unique heritage.

The challenge in designing banknotes is to create pieces of art that incorporate features of cultural significance, while integrating a suite of security elements needed for functional banknotes. A banknote designer must therefore have a specialised combination of skills, and needs up-to-date expertise as well as considerable experience.

But what exactly makes a banknote a functional banknote? What are the special challenges of designing banknotes?

As shown in figure 1, the process of designing banknotes has to account for and manage a set of constraints. As well as artistic talent, very specific technical knowledge in several areas is needed.

1 Security

Security features have to be strong in two ways. Firstly, they need to be difficult to replicate. Secondly, they need to be easy for members of the public to verify. It is vital that a banknote integrates the right selection of security features into the right substrate. The term ‘substrate’ refers to the underlying material on which the designs are printed. New Zealand banknotes have been using polymer substrate since 1999.

2 Cultural representation

Banknotes carry significant weight as representatives of the culture of a country, and are sometimes referred to as ‘a country’s business cards’. Therefore, the New Zealand public should be able to identify with the designs, and value their artistic appearance. The Reserve Bank wanted to refresh the look of the notes and modernise the designs, while emphasising the connection with New Zealand’s bicultural heritage.

Nielsen conducted a survey for the Reserve Bank in 2010, which can be obtained from the RBNZ’s website http://rbnz.govt.nz/notes_and_coins/banknote_upgrade/4436446.pdf (Consumers) and http://rbnz.govt.nz/notes_and_coins/banknote_upgrade/4436447.pdf (Retailers). The 2010 results were confirmed in a repeat survey conducted in 2013. Results are due to be published soon.
3 **Accuracy**
There are many details in banknotes and it is important that these are portrayed accurately. The New Zealand theme in the current banknotes focuses on native flora and fauna, and attention to detail is fundamental when depicting these in the new banknotes.

4 **Banknote equipment**
With the growing use of equipment that automatically processes banknotes, such as self-service check-outs in supermarkets and automated teller machines (ATMs), a new note design needs to be such that the equipment can be adapted to detect its machine-readable security features and to process the notes.3

5 **Manufacturing**
The printing processes for banknotes are very sophisticated but, like any other manufacturing process, they impose constraints on the product. If these constraints are not considered in designing banknotes, designs might be chosen that could not be mass-produced with existing printing technology.

6 **Accessibility**
It is important that visually-impaired people are able to use banknotes, and a successful banknote design features strong contrasts and large fonts to assist in recognising the value of the banknote. Although varying the size (both length and height) of notes by denomination is the most effective way to enable visually-impaired people to tell the notes apart, this upgrade was the ideal opportunity to

---

3 The Reserve Bank completed a consultation with the banknote handling industry in September 2014 and found over 30,000 pieces of equipment in New Zealand that process, accept, dispense, and in some cases recycle banknotes. These machines are capable of determining the value and authenticity of the notes. For example, many ATMs now accept cash deposits. As with self-service kiosks at supermarket check-outs, sophisticated sensors within the equipment read the banknotes and recognise their value and whether they are genuine or fake.
address some of the design issues in the current series and make recognition easier.¹

Unlike many other central banks in developed economies, the Reserve Bank is not affiliated with any banknote designers and printers. An extensive stakeholder consultation took place to refine the above list of requirements in line with the specific needs of the New Zealand public. The Reserve Bank also worked closely with various expert consultants such as representatives from the Museum of New Zealand Te Papa Tongarewa (Te Papa) and the New Zealand Police to ensure the designs would meet the requirements. To identify suppliers for the designs and for the subsequent product development and production services, a procurement plan was established, which is described in the next section.

3 Design process

Procuring the designs was part of a wider procurement exercise. Figure 2 shows the steps in the development and production of the next New Zealand banknotes, and several of these were managed in a tender process.

Before the banknote designers could start work, the Reserve Bank determined its requirements for the new banknotes in consultation with stakeholders (step 1), and selected the images for the notes (step 2). A suite of security features, including a substrate, was selected through a request for information (step 3), which was the first step in an open, multi-stage procurement process.

The selected features, images and requirements were combined in the design specifications, which the Reserve Bank supplied in the tender for the designs (step 4). These specifications were used by banknote designers to create their conceptual models of the banknotes. The conceptual models that won the tender are currently being converted to prototypes and master banknotes during the product development phase, before the print production commences (steps 5 and 6).

Steps 1 to 4 are described in more detail in the following sections. At present, work continues on the final two steps in the process.

3.1 Determining requirements

The Reserve Bank began consulting with stakeholders in 2011. Key stakeholders for the design were groups representing the visually impaired, and manufacturers of banknote-handling equipment. The Reserve Bank was able to establish a set of requirements

¹ The use of tactile features was considered but discarded, because most available tactile features do not last well, limiting their usefulness as a way of identifying notes. They can also cause production and processing issues. Feedback from visually impaired people was that size is the preferred method of recognition, as it is a permanent, non-degrading feature of a note.
specific to the needs of visually impaired people, such as high contrast numerals, large fonts, greater colour variation between denominations, and above all, the continuation of varying sizes. The manufacturers of banknote equipment had very specific requirements for the placement of security features such as windows, and the selection of machine-readable technologies.

The Reserve Bank also believed that the use of te reo Maori (Maori) should be increased, better reflecting New Zealand’s bicultural heritage. Adding Maori wording such as Aotearoa recognises the value and status of Maori as one of the two official spoken languages. The Reserve Bank consulted with Te Puni Kokiri and the Maori Language Commission on the appropriate translations.

3.2 Image selection

The current designs contain a large number of images and details, which made it difficult to retain all of them when integrating additional security features. In the field of banknote design, this is often referred to as ‘limited real estate’.

Most design elements within the existing themes were retained, such as the portraits and vignettes on the front of the notes and the birds and background scenes on the back. It was also decided to keep the dominant colour of each denomination the same, to ensure that the new notes would be easily recognisable alongside the current notes.

The Reserve Bank made a selection of images available for the designers to choose from. The images covered the same motifs as on the current banknotes, to ensure that the New Zealand heritage represented in the banknotes would be preserved.

3.3 Request for information

The procurement strategy reflected the complexity of the product and was managed through an open, multi-stage international tender process. The process was independently reviewed by an external consultancy before and after execution.

In 2012, the Reserve Bank issued a Request for Information (RFI), seeking specific technical information regarding security features and substrates that were available in the market at that time. (See box for more information.) In the same RFI, the Reserve Bank sought information on the design and print capabilities in the domestic and international market. Companies that submitted expressions of interest were considered for the invitations to tender in the following year.

With the information gathered in the RFI, the design specifications were established, covering a suite of security features and a collection of images and portraits, as well as other design requirements such as colours, text, and the placement of features. The specifications formed the basis of the next step in the procurement process. Companies that expressed an interest during the RFI were invited to the design tender. No New Zealand-based companies participated in the RFI.

3.4 Request for tender

In 2013, the Reserve Bank issued two Requests for Tender (RFT) in parallel. One was for the design of the conceptual models (RFT1) and the other sought proposals for the product development and the production of banknotes (RFT2). This approach gave the Reserve Bank the option of selecting a design from one company while selecting another company to develop and print the banknotes, ensuring transferability of the preferred designs.

The tendering ensured that there was both artistic variety and a choice of designs. Seven design proposals were submitted by six overseas companies. Although these submissions were based on the same specifications, the outcomes were very different — as the Reserve Bank had hoped.

The most important question was whether the designs enhanced resilience to counterfeiting. To determine this, all designs were reviewed by industry experts and the New Zealand Police.

It was also important to consider whether the designs were aesthetically pleasing and representative of New Zealand’s cultural heritage. To evaluate the public perception of the different designs, the Reserve Bank conducted a number of confidential focus groups with a wide range of participants representing the New Zealand public, as well as tourists and visually impaired people.

---

Further, Te Papa assessed all design submissions with a selection of cultural, arts, botanical and ornithological experts.

To answer the question of whether the designs would function in banknote equipment without major disruption to the industry, the Reserve Bank reviewed the design proposals with equipment manufacturers.

Another important question was whether the designs could be successfully converted into actual banknotes, and be manufactured in large volumes. For this, the Reserve Bank worked with various consultants, including experts on security and printing.

There were other considerations, such as the ease of communicating the designs to the general public during the launch of the new series, or subsequently to cash handlers if they sought advice when verifying the authenticity of a banknote.

Overall, the feedback of the various experts and focus groups was very consistent and the evaluation pointed clearly to one of the tendered designs, which was accordingly the one selected.

4 Series 7 designs

The designs submitted by the Canadian Banknote Company Ltd. (CBN) were the ones selected, and CBN also won the tender for the printing of the banknotes.

The designs show strong counterfeit resilience through the secure and clever integration of security features. The note designs are also good for banknote equipment recognition. The experts who evaluated the designs for their feasibility for large-scale manufacture deemed this to be achievable.

During the evaluation of the aesthetic appeal and the public perception of the designs in focus groups, most focus group participants reacted enthusiastically to the new designs. Overall, the perception was that the notes looked crisp and professional. It was felt that they were a good evolution of the current banknotes, and a good blend of the old and the new.

The designs achieved a feeling of being representative of New Zealand’s culture and heritage and were considered formal and recognisable as legal tender, something that is of the utmost importance to the Reserve Bank. Focus group participants felt strongly that the banknote designs were important for how they reflected New Zealand as a nation to international visitors.

Focus group participants particularly liked the tukutuku panels being on the left hand side of the portrait side of the note, as bringing them to the foreground of the designs made this feature more prominent. Further, the portraits had a soft focus quality, which meant they did not dominate the design. Participants considered them to be much more appealing and much warmer looking than those on the current banknotes, and also compared to other design proposals.

From an artistic perspective, Te Papa noted that the banknotes were well designed with clear, easy-to-read text, and that primary images were depicted at a decent scale and are identifiable. Te Papa also noted that these designs bore a strong resemblance to the current banknotes but were bolder with new design features.

CBN’s designs best satisfied the various requirements, and the Reserve Bank purchased the designs earlier this year.

The front and back images of the conceptual
Figure 3
New Zealand's new banknote designs
Selection criteria for security features

The selection of security features was one of the most challenging parts of determining the design specifications. Every aspect of a banknote is intended to enhance its security, and the selection of security features affects the entire design.

But what is there to consider when choosing features for New Zealand?

Firstly, the counterfeiting environment was looked at, determining the domestic and international threat. The Reserve Bank looked at emerging reproduction technologies, and security features used in overseas currencies. The use of, and awareness of the current security features by consumers and retailers provided further insight into the effectiveness of some features. As a result, it was established that security features should be easy for users of the notes to verify, and easy for them to understand and remember.

Secondly, the Reserve Bank decided on some fundamentals, such as the number of public and machine-readable features, and the use of the same features in all denominations.

Thirdly, some important constraints were established. The features had to be provided by a reliable supplier, and they had to be ready to be put into production. The Reserve Bank did not want to be in a position where it had to delay the project because it was not currently possible to manufacture notes with the chosen features.

With these decisions and constraints in mind, the project team evaluated nearly 100 possible security features in terms of how difficult it would be to replicate them, how easy it would be to verify them, their durability, and their cost.

A few features were clear front-runners, being very strong counterfeit deterrents. However, some features are not compatible with all choices of substrate (paper, polymer or a hybrid). The Reserve Bank evaluated combinations of substrate and security features, and felt that polymer best allowed the notes to incorporate advanced security features. These include windows containing images which change colour and appearance when the note is tilted. These security features are easy for the public to check but difficult to replicate.

5 Conclusion

The Reserve Bank has been working on the project to introduce the new banknote series since 2011. The Reserve Bank chose an open tender process to select the designs for the new series, and consulted widely to establish design requirements and later evaluate the proposed designs. Earlier this year, the Reserve Bank purchased the conceptual models for the new notes from CBN, and the target release date for the first two denominations is October 2015.

At present, the first prototype banknotes are being developed by CBN with the Reserve Bank’s continued involvement. In parallel, the Reserve Bank is working closely with the banknote handling industry to ensure a smooth introduction of the new banknotes.

The communications campaign ‘Brighter Money’ was launched in November 2014, making the high level designs public. Closer to the release dates of the new notes, the focus of the campaign will switch more to educating the public about their security features.
Recent issues of the Reserve Bank of New Zealand Bulletin

Click to load the PDF

Vol. 77, No. 2, June 2014
How volatile are New Zealand's terms of trade? An international comparison

The interaction between monetary and macro-prudential policy

Can't see the wood for the trees - shedding light on Kauri bonds

Vol. 77, No. 3, September 2014
The insurance sector and economic stability

Vol. 77, No. 4, October 2014
Household debt: a cross-country perspective

Vol. 77, No. 5, October 2014
Documenting the goals for monetary policy: some cross-country comparisons