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**Benchmarking Study on the
Incorporation of Braille Functionality
in Philippine Banknotes**

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Abstract

The BSP has been improving the design of the Philippine Peso to enhance its accessibility to the visually challenged Filipino. This study seeks to provide baseline information on the accessibility features of banknotes across different jurisdictions. It also recommends some action points that may be considered in the design of Philippine banknotes.

Vision impairment is considered one of the prevalent disabilities among Filipinos and various laws have been enacted to provide accessibility to public goods and promote inclusivity for persons with disability. To further this advocacy, this study supports the inclusion of tactile markings in the future design of Philippine banknotes and recommends the intensification of information campaign to promote public awareness on these accessibility features.

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Keywords: vision impairment, Braille functionality, currency accessibility, financial inclusion

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1. Introduction

In pursuit of the Bangko Sentral ng Pilipinas' (BSP) mandate to preserve and maintain the integrity of the Philippine Peso, the BSP continues to conduct in-depth and extensive studies on the design, specifications, and other features of the Philippine currency. While upgrading the features of banknotes and coins to enhance their security against counterfeiting is crucial, it is equally important that the design and accessibility features are considered to meet the needs of the various sectors of the society – a strategy to achieve the BSP's advocacy of bringing the BSP closer to the people. One of the sectors that is given consideration in the design of currency notes and coins is the Persons with Disabilities (PWD) sector, more particularly those with vision impairment.

According to the World Health Organization's World Report on Vision, vision impairment happens "when an eye condition affects the visual system and one or more of its vision functions," and this affects at least 2.2 billion people globally (World Health Organization, 2019). It has three categories: blindness, low vision or partial sight, and color deficiency, more commonly known as color-blindness (Institute for Disability Research, Policy and Practice, n.d.).²

With their physical condition, visually impaired individuals experience difficulties in their daily activities such as paying for goods and services with cash. Thus, providing accessibility features in physical currency can improve their ability to conduct financial transactions. This sense of inclusion supports PWDs' financial independence and overall economic well-being.

In view of the foregoing, this study seeks to provide baseline information on the accessibility features of banknotes across different jurisdictions. It also recommends some action points that may be considered in the design of Philippine banknotes.

The paper is structured as follows: Section 2 provides background information on the magnitude of vision impairment in the Philippines and laws governing the financial inclusion of persons with disabilities (PWD). Section 3 discusses the best practices in currency accessibility features across several countries. Section 4 expounds on the accessibility features in Philippine Peso banknotes. Section 5 proposes some action plans for policy consideration.

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² Leading causes of vision impairment are the following: uncorrected refractive errors; cataract (clouding of the lens of the eye); age-related macular degeneration (blurred/reduced central vision); glaucoma (damaging of the optic nerve); diabetic retinopathy (diabetic complication that affects the eyes); corneal opacity (scarring/clouding of the cornea); and trachoma (bacterial infection that affects the eyes).

2. Vision Impairment in the Philippines

Based on the available 2016 National Disability Prevalence Survey, 81.0 percent of Filipinos have disability or are to be considered PWDs, in which 22.0 percent are mild, 47.0 percent are moderate, and 12.0 percent are severely disabled. Only a small portion (19.0 percent) of the population experienced no disability (Philippine Statistics Authority, 2019). The survey also showed that a higher percentage of females than males experience moderate (51.0 percent) and severe (60.0 percent) disability. In addition, 24.0 percent of individuals below the age of 60 experienced mild disability; over 50.0 percent of individuals aged 40 and above experienced moderate disability; and almost one-third of the population aged 60 and over experienced severe disability.

Considering individuals with severe disability aged 15 and older, the following areas of concern were highlighted as the most affected life aspects among PWDs:

- 41.0 percent mobility (with extreme problem with walking a kilometer)
- 23.0 percent seeing (with extreme problem with seeing at a distance)
- 14.0 percent hearing (with extreme problem in hearing in a noisy room)
- 10.0 percent self-care (with extreme problem in looking after own health)

It also revealed health conditions and impairments that individuals with severe disability commonly encounter. These are vision loss (57.0 percent), back pain (49.0 percent), arthritis (40.0 percent), hypertension (36.0 percent), and sleep problems (31.0 percent). Forty-nine (49.0) percent of the survey respondents who are individuals aged 15 and older with severe disability are employed or working while 34.0 percent of them experienced difficulties in applying for and securing a job. Eleven (11.0) percent of the respondents have extreme difficulty in completing tasks at work due to their disabilities.

The 2018 Philippine Eye Disease Study reports that the prevalence of visual impairment (i.e., visual acuity of 6/18 or worse in the better eye) in the country is 1.98 percent. The major causes identified are cataract affecting 1.112 million Filipinos followed by uncorrected error of refraction (398,688), glaucoma (283,287) and maculopathy (209,863) (Philippine Eye Research Institute, n.d.).

2.1. Laws and regulations governing financial inclusion of PWD in the Philippines

As defined in Republic Act (RA) No. 10524³, PWD include those who have long term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others. Chapter 1 (Employment) of RA No. 7277, as amended, or the Magna Carta for Disabled Persons provide for equal opportunities for employment for PWDs, including sheltered employment⁴ and apprenticeships. All qualified applicants or employees shall be entitled to the same terms

³ An Act Expanding the Positions Reserved for Persons with Disability, amending for the purpose Republic Act No. 7277, as amended, otherwise known as the Magna Carta for Disabled Persons.

⁴ Sheltered Employment refers to the provision of productive work for disabled persons through workshops providing special facilities, income-producing projects, or homework schemes with a view to giving them the opportunity to earn a living thus enabling them to acquire a working capacity required in open industry. – Section 4 Definition of Terms of Republic Act No. 7277, as amended.

and conditions of employment and compensation packages including applicable incentives and allowances as qualified able-bodied personnel. PWDs are among the vulnerable groups in the country that need attention from the government. This is one of the reasons why the institutional and legal environment has been made favorable to this group, especially in employment.

Employability encompasses an individual's readiness for work as well as factors influencing a person's capacity to get a job, move between jobs, or improve their job (McQuaid and Lindsay, 2005). The concept of employability plays a crucial role to local, national, and international labor market policy. Subsequently, the consideration of employability of PWDs and its impact to the economy is vital. In addition to the Magna Carta for Disabled Persons, the following policy initiatives provide protection to the rights of PWDs particularly on their employability:

Table 1. Enacted laws preserving PWD rights to equal employment opportunities

Law/Policy	Basic Provision/s
Republic Act No. 10524 or An Act Expanding the Positions Reserved for Persons with disability, amending for the purpose Republic Act No. 7277, as amended, otherwise known as the Magna Carta for Persons with Disability	Amending Section 5 of Republic Act No. 7277, that "At least one (1) percent of all positions in all government agencies, offices or corporations shall be reserved for PWD: Provided, that private corporations with more than one hundred employees are encouraged to reserve at least one (1) percent of all positions for PWD."
Executive Order No. 261 (July 17, 1995)	Creating the Committee on Employment Promotion, Protection and Rehabilitation of Persons with Disabilities which is tasked to coordinate and monitor compliance with the employment provisions of the Magna Carta for Disabled Persons and relevant laws.
Republic Act No. 1179 or the Vocational Rehabilitation Act	An act to provide for the Promotion of Vocational Rehabilitation of the Blind and other Handicapped Persons and their Return to Civil Employment

Vision impairment is one of the seven major categories of disabilities (National Council on Disability Affairs (NCDA) Board Resolution No. 1 Series of 2006). A visually impaired person is one who has impairment of visual functioning even after treatment and/or standard refractive correction and has visual acuity in the better eye of less than 6/18 for low vision and 3/60 for blind, or a visual of less than 10 degrees from the point of fixation. A certain level of vision impairment is defined as legal blindness. One is legally blind when your best corrected central visual acuity in your better eye is 6/60 or worse or your side vision is 20 degrees or less causing disability.

In a study conducted in 2013 on the employment of PWDs in the Philippines, 50.5 percent of the employed PWDs in the urban areas are visually impaired while 15.6 percent of them are employed in the rural areas. On the other hand, incidence of unemployment for the

visually impaired is higher in the rural areas at 30.0 percent than in the urban localities at 21.3 percent (Mina, 2013). Moreover, most of the visually impaired employed PWDs have jobs as technicians and associate professionals (62.8 percent), followed by those who are laborers and unskilled workers (14.2 percent).

To promote financial inclusion of PWDs, the BSP issued a memorandum⁵ to all BSP-supervised financial institutions reminding them to refrain from discriminatory practices against persons with disabilities. The BSP enjoins the financial institutions in the country to make it easier for persons with disabilities to transact with them by providing additional services to aid those who are visually impaired as well as those with mobility limitations. Further, this issuance aims to ensure that the banking PWDs' rights are always respected. Financial institutions are required to adhere to laws and regulations against discriminatory practices toward PWDs, including but not limited to:

- Refusal to accept government issued PWD ID cards for account opening and other transactions
- Rejection of blind people/clients who are trying to open accounts
- Requiring blind people to open only joint accounts with those who are not visually impaired.

Aside from putting in place mobility aids (e.g., ramps) and the Braille system in bank premises and automated teller machines, financial institutions are also reminded to provide express lanes for PWDs within their premises.

The BSP remains committed to the central motivation of its National Strategy for Financial Inclusion (NSFI). It upholds that access to basic financial products and services, such as savings, payments, credit, and investments, "makes a substantial positive difference in people's lives" and that greater financial inclusion "contributes to financial stability and economic development and is critical for achieving inclusive growth" (NSFI, 2015).

3. Cross-Country Analysis of the Accessibility Features in Banknotes

For many years, central banks have been committed to providing cash as a reliable form of payment. It is considered a public good and is an important contributor to financial inclusion and economic activity. As such, central banks design their currency to be accessible to all members of society, including those with vision impairment.

Below are several accessibility features that are currently being used as sensory aids to identify and discriminate banknote denominations. Annex A provides more information on Braille and tactile markings on banknotes of various central banks.

3.1. Colors

Banknote color plays a prominent role in distinguishing banknote denominations. A predominant color gives a simple method to recognize currency value especially for people

⁵ Memorandum No. M-2021-040, signed by BSP Deputy Governor Chuchi Fonacier on July 16, 2021.

who have difficulty in reading words or numbers. In addition, high color contrast allows for a more noticeable color cue not only for people with low vision but for those with normal vision as well.

As such, most countries have different predominant colors for each denomination. A survey conducted by the United States' National Research Council (NRC) in 1995 across 171 countries revealed that more than 97.0 percent assigned a differentiated color scheme for all denominations in a banknote series (NRC, 1995). Further, 91.3% of the 23 central banks evaluated by the Reserve Bank of Australia (RBA) in 2014 have banknotes featuring primary colors that differ by denomination (Springer et al., 2015).

3.2. Large, high-contrast numerals

Like predominant banknote colors, large and bold numerals indicating the monetary value that contrast with the background of the note helps people, both with normal and impaired (partial) vision, in discriminating among denominations. In low lighting where color cues become less reliable, a large high-contrast numeral facilitates recognition of the note's denomination. In the 2014 RBA survey, 95.7% of participating issuing authorities utilized numeral size as an accessibility feature (Springer et al., 2015).

Dark characters on light background are more legible under high illumination, but the reverse is true in poor lighting conditions. Light numerals printed on dark background further benefit some visually impaired who experience light scatter caused by diseases such as cataract (NRC, 1995). Hence, a study by the De Nederlandsche Bank (DNB) recommends inclusion of positive-negative numerals – one denomination figure to be printed as a dark numeral on light background, and the other as light on dark background (De Heij, 2009). Several countries such as Hong Kong, Indonesia, Israel, and Canada have already integrated positive-negative numerals in their current banknote design (Hong Kong Monetary Authority, 2020; Bank Indonesia, n.d.; Bank of Israel, n.d.-a; Bank of Canada, n.d.).

3.3. Size variation

Different banknote sizes are particularly beneficial to those who are blind and are not able to identify colors or large, bold numerals. One example of size variation in banknotes is that the long edge differs (across denominations), while the short edge remains constant. Another is that both edges vary in measurement. In practice and generally, the size of the banknote increases as the value also increases.

When variation is done in a single dimension, a secondary cue may assist correct identification of banknote denomination since errors in judgement may happen when there are more than four items being assessed (NRC, 1995). Hence, some countries such as Hong Kong and Australia provide free size templates or measuring gauges during launch of the banknotes (Hong Kong Monetary Authority, 2020; Reserve Bank of Australia, n.d.). Over time, it has been observed that the blind learns to recognize the denominations without need for the template (NRC, 1995).

Over 120 countries have issued banknotes that vary in size for different denominations while 78.3% of central banks surveyed by RBA in 2014 also employed size variation (NRC, 1995; Springer et al., 2015). The Currency Benchmark 2020 report of the Central Banking Institute also revealed that 66.0% of participating countries use banknote size as aid for the visually impaired. However, the investment for initial implementation of size variation is high. In the United States, the startup cost is approximately 49.0 percent of the 2006 printing cost or USD 467 million (Williams and Anderson, 2007). The conduct of information campaigns for public acceptance of the notes and provision of size templates add to the implementation cost.

3.4. Tactile marks

Generally, banknotes have a distinct tactile feel because of their substrate's composition, particularly for paper banknotes, and the print process used in its production. Banknote substrates are traditionally made using fibers such as cotton, linen, and abaca that give a certain roughness to a genuine note. Moreover, the embossing from the intaglio printing process used in banknote production adds to the roughness of the note. Hence, tactile features help authenticate banknotes. This unique "feel" or "touch" is even reported to be the most common method used by the public and bank employees for authentication of US Dollar notes (Williams and Anderson, 2007).

In addition to the tactile quality of genuine notes, central banks include other features with enhanced tactility. This increases accessibility of the currency for the public. In the 1995 NRC survey, 23 of 171 countries have adopted intaglio tactile marks in their banknotes while 82.6% of participating central banks in the later 2014 RBA survey also opted for the same accessibility feature (NRC, 1995; Springer et al., 2015). Further, in the 2020 Currency Benchmark report, raised ink is the primary accessibility feature (81.0%) incorporated by central banks in banknotes (Central Banking, 2020).

These tactile marks or "blind codes" may come in various designs and representations depending on the currency issuer. Commonly, these consist of raised dots, lines, and shapes as basic elements, and are often located at the edges of the notes where people spontaneously receive the note by hand (first portion in contact). Logical coding schemes for denomination are created using these basic tactile elements, except for tactile shapes.

Generally, the frequency of tactile marks increases with denomination. This coding scheme is used in the most recent banknotes issued in Hong Kong, Indonesia, Israel, Switzerland, Canada and Australia while alternative coding schemes involving varying both frequency and orientation have been adopted in current banknotes from Malaysia and Brazil (Hong Kong Monetary Authority, 2020; Bank Indonesia, n.d.; Bank of Israel, n.d.-a; Swiss National Bank, n.d.-a; Bank of Canada, n.d.; Reserve Bank of Australia, n.d.-b; Bank Negara Malaysia, n.d.; Banco Central de Brasil, n.d.). Moreover, banknotes featuring tactile shapes include the circulating Polish notes as well as earlier issuances of Indonesian, Indian, Israeli, and Swiss banknotes (Narodowy Bank Polski, n.d.; Bank Indonesia, n.d.; Reserve Bank of India, n.d., Bank of Israel, n.d.-b, Swiss National Bank, n.d.-b). For these notes, the public may require longer learning time due to lack of logical connection between the banknote's tactile shape and value.

Studies have shown that addition of tactile marks in banknotes significantly increases accuracy in identification of notes (De Heij, 2009; Springer et al., 2015). Tactile marks are primarily created by intaglio print process using colored or transparent ink. This process may also be employed for blind embossing (using an uninked intaglio plate) that creates colorless relief lines or images such as in Australian notes (Williams and Anderson, 2007; Advanced Security Solutions, n.d.; Reserve Bank of Australia, n.d.-b). This is the same technology used in producing existing raised prints in banknotes; hence, incorporating tactile marks using intaglio is expected to add minimal cost to the existing production process. However, a drawback of intaglio tactile features is significant degradation over time. This decreases their reliability in worn notes as natural wear and substrate breakdown from circulation of banknotes may render their “raised” tactile features flat (Springer et al., 2015).

As alternative to intaglio prints, ‘bumps’ stamped or embossed into the banknote substrate have been incorporated in the recent banknotes issued in Canada (Bank of Canada, n.d.). Compared with intaglio-printed tactile marks, embossed features showed higher durability in several physical and chemical tests (Springer et al., 2015). However, the required technology is also expected to be more expensive than traditional intaglio printing since production of this feature involves embossing onto the substrate then back-coating in an additional production run to prevent the embossed dots from flattening out (De Heij, 2009). The Bank of Canada estimates that the addition of this tactile feature corresponds to about 3.0 percent of the annual note order cost (Samuel, 2010).

Should the production cost of the embossed tactile structures be prohibitive, central banks may opt for visible or transparent intaglio tactile marks. However, this must be complemented with strong implementation of policies to ensure that only fit notes will remain in circulation. This shall maintain the reliability of these tactile marks as accessibility features.

3.5. Braille as tactile marks

Invented by Louis Braille in the 19th century, Braille is a system for reading and writing used by the visually impaired (Roth and Fee, 2011). Each character consists of one to six embossed points within a unit of space known as a Braille cell. Braille is read by passing one’s fingers through these cells and the arrangement of the raised points within a cell corresponds to different alphanumeric characters (Roth and Fee, 2011; American Foundation for the Blind, n.d.).⁶

In banknote production, the embossed points comprising the Braille characters are primarily created using intaglio printing. Although cost-efficient, intaglio printing can only produce embossed prints with heights up to 100 micrometer (μm) using digital intaglio origination techniques or up to 60 μm for earlier chemical etching processes. These Braille dot heights are significantly below the recommended value of 230 μm to 500 μm (De Heij, 2009). The US Library of Congress recommends a height of 480 μm for Braille dots on paper. Moreover, a study by Lei, et. al. (2019) reveals that text in embossed Braille dots with lower

⁶ See Annex B for the illustration of the Braille system.

height (380 µm, 180 µm, 40 µm) can still be accurately read. However, at the lowest Braille dot height of 40 µm, Braille reading speed significantly declined.

Despite sub-optimal characteristics of intaglio-printed Braille on banknotes, several countries have incorporated Braille codes to their banknotes to assist the visually impaired in denominating currency. In the 2020 benchmarking study conducted by the Central Banking Institute, only 38.0% of 32 participating countries utilize Braille dots as accessibility features.

In practice and as with other tactile marks, Braille codes are primarily integrated into the design of the note. This is typically done by printing the embossed dots in the dominant color of the banknote (Hong Kong Monetary Authority, 2020; Monetary Authority of Singapore, 2021; Bank of Thailand, 2013, 2014, 2015a, 2015b, 2018; Brunei Darussalam Central Bank, n.d.). The Bank of Thailand further utilized Braille marks as design elements by featuring stylized Braille points in the shape of flowers (Bank of Thailand, 2013, 2014, 2015a, 2015b, 2018). Colored Braille codes also have the advantage of benefitting the normally sighted by serving as additional visible features for denominating banknotes.

Braille marks on banknotes have also been found to use codes from the same set of basic characters despite Braille being adapted to various languages. However, usage of the characters has become arbitrary resulting in variances in denomination coding schemes. For instance, the current circulating banknote series in Brunei and Hong Kong contain intaglio-printed Braille marks that code for the banknote's denomination, albeit omitting the character that signals a numeral (Brunei Darussalam Central Bank, n.d., Hong Kong Monetary Authority, 2019, 2020). Meanwhile, the circulating Portrait Series of Singapore features intaglio-printed Braille marks that correspond to the order of the banknote by value, but without the lead-in character for numerals (e.g., SGD 2 contains the Braille code for "1" as it is the banknote with the lowest denomination in the series while SGD 10,000, the 7th and highest-denominated banknote, is marked with the Braille code for "7") (Monetary Authority of Singapore, 2021). More complex is the coding system developed by Thailand for Series 16 and 17 banknotes, both currently in circulation. In these banknote series, the two lowest denominations use the Braille code for the non-zero number, still without the lead-in character for numeral (i.e., "2" for THB 20 and "5" for THB 50) while the codes in the three highest denominations correspond to letters (i.e., "H" representing "Hundred" in THB 100, "F" for "Five hundred" in THB 500 and "T" for "Thousand" in THB 1000) (Bank of Thailand, 2013, 2014, 2015a, 2015b, 2018).

These coding systems in banknotes with Braille run contrary to convention and inherently assume that the reader shall disregard letters which the same Braille characters code for. However, these variances do not appear to significantly affect denomination recognition as several countries such as Hong Kong, Singapore and Thailand have all retained the Braille feature in multiple banknote series despite having different coding schemes (Hong Kong Monetary Authority, 2020; Monetary Authority of Singapore, 2021; Bank of Thailand, n.d.). Meanwhile, other countries such as Canada and the Netherlands refrained from adding Braille and opted to use their own logical scheme for tactile features after research indicated the low percentage of the visually impaired population that can read Braille (Lederman and Hamilton, 2002; De Heij, 2009). In this perspective, addition of Braille may be construed as favoring the learned few at the expense of the rest of the visually impaired. The issuing authority must,

therefore, conduct extensive information campaigns to assure the public that Braille in banknotes is adopted to promote inclusivity rather than the reverse.

3.6. Machine-identifiable features

With the advent of more advanced, state-of-the-art technology, there are a lot of accessibility applications that aid persons with disabilities that may be installed in smartphones, tablets, and other gadgets. There are several applications that can quickly and reliably assist the visually impaired in identifying the denomination of banknotes, such as the Seeing AI app developed by Microsoft and the NantMobile Money Reader developed by IPPLEX Holdings Corporation. Moreover, there are mobile apps specifically developed for currencies such as those developed by Giesecke & Devrient (G+D) for Thailand Baht, Armenian Dram, Malawi Kwacha, and Eswatini Lilangeni, the Mobile Aided Note Identifier (MANI) developed by the Reserve Bank of India for the Indian Rupee, and the EyeNote® App and IDEAL® Currency Identifier developed by the Bureau of Engraving and Printing for the US Dollar.

4. Accessibility Features in Philippine Peso Banknotes for the Visually Impaired

The BSP has always been committed to provide the Filipino people with adequate and timely supply of quality notes and coins. Moreover, the BSP continues to improve our banknotes and coins to safeguard the integrity of our local currency and ensure that the Philippine Peso is easy-to-authenticate and easy-to-use.

For example, the note color was intensified for the New Generation Currency (NGC) Banknote Series, which was released in December 2010, as compared with the previous New Design Series (NDS) banknotes. The intention was to allow the public to easily distinguish NGC notes from among each other. However, there was a concern with the 1000-Piso and the 100-Piso; there was feedback that the colors of the said notes were slightly similar thus confusing some users. In response to suggestions from the public to make the 100-Piso easier to distinguish from the 1000-Piso, the BSP enhanced its mauve color in 2016.

In addition to the predominant colors, the value panel that indicates the note's denomination for NGC banknotes was also improved; larger numerals were used in the upper left corner as compared with NDS banknotes. The value panels of the 1000-Piso and 500-Piso enhanced NGC (eNGC) banknotes launched in July 2020 were further improved by employing bold numerals with a rolling bar effect.

In 2002, BSP introduced in the 200-Piso NDS banknote a "code for the blind" consisting of three geometric shapes in raised print. In 2010, tactile features in Philippine banknotes were expanded to all denominations by the inclusion of enhanced intaglio-printed denominational values on the face of the succeeding NGC Banknote Series. Enhancement of the NGC banknotes in 2020 featured the addition of tactile marks with higher tactility than the value panels, increasing further the responsiveness of the Philippine notes to the needs of the visually impaired.

Moreover, current Philippine banknotes already include accessibility features for both the blind and partially sighted (Figure 1). The eNGC banknotes have vivid colors that are unique for each denomination and large numerals in high contrast. These features were incorporated in the banknote design to aid the partially sighted as well as those with normal vision. Tactile marks with simple and logical coding scheme placed at the optimum location, i.e., the short sides where the note is frequently touched, were added to help both blind and partially sighted in distinguishing the value of currency notes.

Figure 1. Accessibility features in the Enhanced New Generation Currency banknotes



Based on the study of Consulta et al. (2020), a survey of the participants in the study shows that the most preferred tactile display is the incorporation of pairs of embossed lines at the short sides of the note like those in the Israeli banknote; this preferred tactile feature is like the representation of the tactile marks in the eNGC banknotes. In addition, identifying banknotes of varied sizes was significantly faster than other tactile features (i.e., holes and larger embossed numerical values). As such, different sizes of banknotes may be considered for future designs of Philippine Peso notes.

5. Conclusions and Recommendations

In view of the foregoing, below are some of the considerations to aid the visually impaired and promote their financial inclusion:

5.1. Intensification of public information campaigns (PICs) on accessibility features in the enhanced NGC Banknote Series.

The BSP has improved the design of the current banknotes, which were recently launched last 29 June 2020, to include tactile marks for the visually impaired. With the incorporation of novel security features and print technologies (e.g., rolling bar value panel,

improved windowed security threads, and distinct color-changing optically variable inks) and the addition of tactile marks, the current Philippine banknotes are at par with the best in the world.

A low PWDs' awareness of the accessibility features that the BSP has incorporated in our banknotes is one of the hindrances that may be addressed through PICs. The BSP may consider using various communication tools to increase public awareness on these features (e.g., easy-to-understand infographics that can easily be shared online) and maximize the reach of social media platforms to discuss the recent banknote enhancements.

5.2. Inclusion of accessibility features in the future design of Philippine banknotes (e.g., tactile embossing that can be represented as Braille marks).

This will allow for a better, cost-efficient, fit-for-purpose currency design that is not just aesthetically pleasing with its intricate images/patterns and safe due to its advanced security features but is also easy-to-use and easy-to-authenticate by all cash users, whether visually impaired or normally sighted.

Sensory aids such as additional tactile marks may be executed through the following options:

Option 1: Use visible intaglio inks to create registered embossing, as normally employed for banknotes and other high security printing documents while taking into consideration the significant degradation of the tactile feature over the banknote's lifetime.

Option 2: Use blind embossing wherein intaglio printing plates are used without intaglio inks; this will create tactile marks that can be felt by the fingertips. As previously mentioned, the disadvantage of using intaglio is the considerable wear and tear of the tactile marks as they are used in circulation.

Option 3: Use tactile embossing to add Braille dots in banknotes. This requires additional equipment that will add the textured elements after the printing of currency notes.

The Braille system may be used as a design element for the additional embossed feature. However, since not all visually impaired persons can read Braille, a simpler logical scheme using dots or lines, or a combination of both, may be used for the tactile marks.

Furthermore, varying sizes of banknotes may be considered for future designs of the Philippine Peso, taking into consideration the capacity of existing automated machines.

References

- Advanced Security Solutions. (n.d.). *Glossary of banknotes*. Retrieved August 23, 2021, from <https://www.security-web.nl/glossary-banknotes/#g641>
- American Foundation for the Blind. (n.d.). *What is Braille?* Retrieved August 17, 2021, from <https://www.afb.org/blindness-and-low-vision/braille/what-braille>
- Banco Central do Brasil. (n.d.). *Second Series of Real*. Retrieved August 22, 2021, from <https://www.bcb.gov.br/en/banknotesandcoins/secondseriesreal>
- Bangko Sentral ng Pilipinas. (2015). *National strategy for financial inclusion*. Retrieved August 20, 2021, from <https://www.bsp.gov.ph/Inclusive%20Finance/PhilippinesNSFIBooklet.pdf>
- Bank Indonesia. (n.d.). *Currency Image*. Retrieved August 22, 2021, from <https://www.bi.go.id/en/ruipiah/gambar-uang/Default.aspx>
- Bank Negara Malaysia. (n.d.). *Current banknote series*. Retrieved August 22, 2021, from <https://www.bnm.gov.my/current-banknote-series>
- Bank of Canada. (n.d.). *Blind and partially sighted*. Retrieved August 22, 2021, from <https://www.bankofcanada.ca/banknotes/audience-specific-resources/blind-and-partially-sighted/>
- Bank of Israel. (n.d.-a). *Current currency series*. Retrieved August 22, 2021, from <https://www.boi.org.il/en/Currency/CurrentCurrencySeries/Pages/Default.aspx#Top>
- Bank of Israel. (n.d.-b). *First Series of the New Sheqel*. Retrieved August 22, 2021, from <https://www.boi.org.il/en/Currency/PastNotesAndCoinsSeries/Pages/Default.aspx#Top>
- Bank of Thailand. (n.d.). *Circulating banknotes*. Retrieved August 17, 2021, from <https://www.bot.or.th/English/Banknotes/HistoryAndSeriesOfBanknotes/Pages/Current Series of Banknotes.aspx>
- Bank of Thailand. (2013, March 27). *The Bank of Thailand to launch new 20-Baht banknote (Series 16)* [Press release]. <https://www.bot.or.th/Thai/PressAndSpeeches/Press/News2556/n1056e.pdf>
- Bank of Thailand. (2014, May 7). *The Bank of Thailand to launch new 500-Baht banknote (Series 16)* [Press release]. <https://www.bot.or.th/Thai/PressAndSpeeches/Press/News2557/n1657e.pdf>
- Bank of Thailand. (2015a, February 24). *The Bank of Thailand to launch new 100-Baht banknote (Series 16)* [Press release]. <https://www.bot.or.th/Thai/PressandSpeeches/Press/News2558/n1058e.pdf>
- Bank of Thailand. (2015b, August 17). *The Bank of Thailand to launch new 1000-Baht banknote (Series 16)* [Press release]. <https://www.bot.or.th/Thai/PressandSpeeches/Press/News2558/n4158e.pdf>

- Bank of Thailand. (2018, March 18). *The Bank of Thailand launches new series of Thai Banknotes (Series 17)* [Press release].
<https://www.bot.or.th/Thai/PressandSpeeches/Press/News2561/n1761e.pdf>
- Braille Authority of North America (n.d.). *Braille basics*. Retrieved September 17, 2021, from <http://www.brailleauthority.org/learn/braillebasic.pdf><http://www.brailleauthority.org/learn/braillebasic.pdf>
- Brunei Darussalam Central Bank. (n.d.). *Issuance of banknotes*. Retrieved August 17, 2021, from <https://www.bdcg.gov.bn/currency>
- Central Banking Institute (n.d.). *Benchmarking service: Currency - Key summary data for each question in the Currency Benchmark survey*. Retrieved September 06, 2021, from <https://www.centralbanking.com/benchmarking/currency/charts/data-points>
- Consulta, L. M. C., Alaurin, M. P. V., Custodio, B. P. & Lee, L. E. N. (2020, June). Analysis of Tactile Display Designs on Philippine Money for the Blind and Visually Impaired. In J. Kalra & N. J. Lightner (Eds.) *Advances in Human Factors and Ergonomics in Healthcare and Medical Devices: Proceedings of the AHFE 2020 Virtual Conference on Human Factors and Ergonomics in Healthcare and Medical Devices, July 16-20, 2020, USA* (Vol. 1205, pp. 382-388). Springer Nature. <https://doi.org/10.1007/978-3-030-50838-8>
- De Heij, H. (2009). *Banknote design for the visually impaired* (No. 702). Netherlands Central Bank, Research Department.
- Hong Kong Monetary Authority. (2019). *2010 Series Banknotes*. Retrieved August 17, 2021, from <https://www.hkma.gov.hk/eng/key-functions/money/hong-kong-currency/notes/design-security-features-of-2010-currency-notes/>
- Hong Kong Monetary Authority. (2020). *2018 Series Banknotes*. Retrieved August 17, 2021, from <https://www.hkma.gov.hk/eng/key-functions/money/hong-kong-currency/notes/design-and-security-features-of-currency-notes/>
- Lederman, S. J., & Hamilton, C. (2002). Using tactile features to help functionally blind individuals denominate banknotes. *Human factors*, 44(3), 413-428.
- Lei, D., Stepien-Bernabe, N. N., Morash, V. S., & MacKeben, M. (2019). Effect of modulating Braille dot height on reading regressions. *PloS one*, 14(4), e0214799.
- McQuaid, R. W., & Lindsay, C. (2005). The concept of employability. *Urban studies*, 42(2), 197-219.
- Monetary Authority of Singapore. (2021). *Circulation currency: Notes*. Retrieved August 17, 2021, from <https://www.mas.gov.sg/currency/Singapores-Circulation-Currency-Notes>
- National Research Council. (1995). *Currency features for visually impaired people* (Vol. 478). National Academies Press.
- Narodowy Bank Polski. (n.d.). *Banknotes currently in use & modernised banknotes*. Retrieved August 22, 2021, from

https://www.nbp.pl/homen.aspx?f=//bezpiecznepieniadze/wszystkie_banknoty_en.html

Philippine Eye Research Institute (n.d.) *Executive summary*. University of the Philippines. Retrieved August 23, 2021, <https://www.peri.ph/philippine-eye-disease-study>

Philippine Statistics Authority. (2019), *2016 National disability prevalence survey*. <https://psa.gov.ph/sites/default/files/2016%20NDPS.pdf> .

Reserve Bank of Australia. (n.d.-a). *Banknote measure device*. Retrieved August 23, 2021, from <https://banknotes.rba.gov.au/resources/for-people-with-vision-impairment/banknotes-measure-device/>

Reserve Bank of Australia. (n.d.-b). *Accessibility features*. Retrieved August 22, 2021, from <https://banknotes.rba.gov.au/resources/for-people-with-vision-impairment/accessibility-features/>

Reserve Bank of India (n.d.). *Security features of Indian banknotes*. Retrieved August 22, 2021, from https://www.rbi.org.in/Scripts/ic_banknotessecurity.aspx

Roth, G. A., & Fee, E. (2011). The invention of Braille. *American journal of public health, 101*(3), 454-454.

Samuel, C. (2010). Making Bank Notes Accessible for Canadians Living with Blindness or Low Vision. *Bank of Canada Review, 2009*(Winter), 32-39.

Springer, K., Subramanian, P., & Turton, T. (2015). Australian banknotes: Assisting people with vision impairment. *RBA Bulletin*, March 1-12.

Swiss National Bank. (n.d.-a). *New banknotes for Switzerland*. Retrieved August 22, 2021, from https://www.snb.ch/en/iabout/cash/series9/id/cash_series9


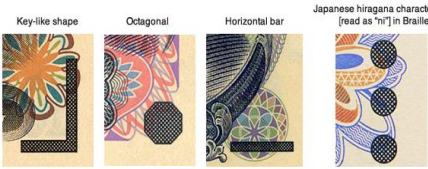
Swiss National Bank. (n.d.-b). *Eighth banknote series*. Retrieved August 22, 2021, from https://www.snb.ch/en/iabout/cash/history/id/cash_history_serie8#t2.


Institute for Disability Research, Policy and Practice. (n.d.). *Visual disabilities*. Utah State University. Retrieved August 17, 2021, from <https://webaim.org/articles/visual/>.


Williams, M. M., & Anderson, R. G. (2007). Currency design in the United States and abroad: counterfeit deterrence and visual accessibility. *Review-Federal Reserve Bank of Saint Louis, 89*(5), 371.


World Health Organization. (2020). *World report on vision*. Geneva: World Health Organization; 2019.


Annex A
Braille and tactile marks on banknotes from other central banks


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Japan</p> <p>Source: https://www.npb.go.jp/en/intro/kihon/genzai.html</p>	<p>Series E (2004) <i>(In circulation)</i></p> 	<p>Braille marks at the lower right and left corners of the JPY 2000 note.</p> <ul style="list-style-type: none"> - Braille codes for the Japanese hiragana character for "two". <p>Tactile shapes at the lower right and left corners of other banknote denominations,</p> <ul style="list-style-type: none"> - JPY 10000: key-like shape - JPY 5000: octagonal figure - JPY 1000: horizontal bar <p>Magnified tactile marks:</p> 	<p>These are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Thailand</p> <p>Source: Circulating Banknotes (bot.or.th)</p>	<p>Series 17 (2018) (In circulation)</p> 	<p>Braille marks are found in all denominations featured as stylized Braille points in the shape of flowers. The denomination coding system differs between high and low denominations. Below are the corresponding Braille codes used:</p> <ul style="list-style-type: none"> - THB 20: 2 without the Braille number sign - THB 50: 5 without the Braille number sign - THB 100: H - THB 500: F - THB 1000: T <p>Tactile lines are found in all denominations, but only facilitate differentiation between low and high denominations.</p> <ul style="list-style-type: none"> - Same number of tactile lines at short edges (THB 20, 50, 100) - Same number of tactile lines at long edges (THB 500, 1000) 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme and using stylized Braille points.</p> <p>Specialized coding scheme</p> <ul style="list-style-type: none"> - Adoption of Braille, a prominent writing/reading system specifically for the visually impaired - Modification of Braille codes, presumably to limit the number of characters - Assumes majority of the visually impaired use Braille


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Thailand</p> <p>Source: Circulating Banknotes (bot.or.th)</p>	<p>Series 16 (2013) (In circulation)</p> 	<p>Braille marks are found in all denominations featured as stylized Braille points in the shape of flowers. The denomination coding system differs between high and low denominations. Below are the corresponding Braille codes used:</p> <ul style="list-style-type: none"> - THB 20: 2 without the Braille number sign - THB 50: 5 without the Braille number sign - THB 100: H - THB 500: F - THB 1000: T <p>Identical tactile lines are found in all denominations; hence, function only as security features rather than accessibility features.</p>	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme and using stylized Braille points.</p> <p>Specialized coding scheme</p> <ul style="list-style-type: none"> - Adoption of Braille, a prominent writing/reading system specifically for the visually impaired - Modification of Braille codes, presumably to limit the number of characters - Assumes majority of the visually impaired use Braille


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Hong Kong</p> <p>Source: 2018 Banknote Series</p>	<p>2018 Banknote Series (In circulation)</p> 	<p>Braille marks are found in all denominations with dots as basic design elements. Braille marks code for the banknote's denomination; however, the character that signals a numeral is omitted.</p> <ul style="list-style-type: none"> - HKD 20: 20 without the Braille number sign - HKD 50: 50 without the Braille number sign - HKD 100: 100 without the Braille number sign - HKD 500: 500 without the Braille number sign - HKD 1000: 1000 without the Braille number sign <p>Tactile lines are found in all denominations; number of tactile lines generally increases with denomination.</p> <ul style="list-style-type: none"> - HKD 20: 1 pair at short edges - HKD 50: 2 pairs at short edges - HKD 100: 3 pairs at short edges - HKD 500: 4 pairs at short edges - HKD 1000: 1 set (consisting of more tactile lines) at short edges 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Multiple accessibility features are used for denominating banknotes, i.e., tactile lines and Braille marks.</p> <p>Multiple coding schemes</p> <ul style="list-style-type: none"> - Simple, logical coding scheme of tactile lines for the public - Specialized coding scheme for the Braille-literate visually impaired; modification of Braille codes implemented, presumably to limit the number of characters


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Hong Kong</p> <p>Source: 2010 Banknote Series</p>	<p>2010 Banknote Series (In circulation)</p> 	<p>Braille marks are found in all denominations with dots as basic design elements. Braille marks code for the banknote's denomination; however, the character that signals a numeral is omitted.</p> <ul style="list-style-type: none"> - HKD 20: 20 without the Braille number sign - HKD 50: 50 without the Braille number sign - HKD 100: 100 without the Braille number sign - HKD 500: 500 without the number sign - HKD 1000: 1000 without the Braille number sign <p>Tactile lines are found in all denominations; number of tactile lines generally increases with denomination.</p> <ul style="list-style-type: none"> - HKD 20: 1 pair at short edges - HKD 50: 2 pairs at short edges - HKD 100: 3 pairs at short edges - HKD 500: 4 pairs at short edges - HKD 1000: 1 set (consisting of more tactile lines) at short edges 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Multiple accessibility features are used for denominating banknotes, i.e., tactile lines and Braille marks.</p> <p>Multiple coding schemes</p> <ul style="list-style-type: none"> - Simple, logical coding scheme of tactile lines for the public - Specialized coding scheme for the Braille-literate visually impaired; modification of Braille codes implemented, presumably to limit the number of characters



Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Singapore</p> <p>https://www.mas.gov.sg/currency/Singapore-Circulation-Currency-Notes</p>	<p>Portrait Series (1999 issuance-paper; 2004 issuance-polymer)</p> <p>SGD 2, 5, 10 (Paper and polymer; <i>in circulation</i>)</p> 	<p>Braille marks are found in all denominations with dots as basic elements. These correspond to the order of the banknote by value, but without the lead-in character for numerals. Below are the corresponding Braille codes:</p> <ul style="list-style-type: none"> - SGD 2: 1 without the Braille number sign - SGD 5: 2 without the Braille number sign - SGD 10: 3 without the Braille number sign - SGD 50: 4 without the Braille number sign - SGD 100: 5 without the Braille number sign - SGD 1000: 6 without the Braille number sign - SGD 10000: 7 without the Braille number sign 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Specialized coding scheme</p> <ul style="list-style-type: none"> - Adoption of Braille, a prominent writing/reading system specifically for the visually impaired - Modification of Braille codes, presumably to limit the number of characters <p>Adoption of Braille codes has been recommended by the Singapore Association of the Visually Handicapped.</p>




Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Singapore</p> <p>https://www.mas.gov.sg/currency/Singapore-Circulation-Currency-Notes</p>	<p>SGD 50, 100, 1000, 10000 (Paper; <i>in circulation</i>)</p> 	<p>Braille marks are found in all denominations with dots as basic elements. These correspond to the order of the banknote by value, but without the lead-in character for numerals. Below are the corresponding Braille codes:</p> <ul style="list-style-type: none"> - SGD 2: 1 without the Braille number sign - SGD 5: 2 without the Braille number sign - SGD 10: 3 without the Braille number sign - SGD 50: 4 without the Braille number sign - SGD 100: 5 without the Braille number sign - SGD 1000: 6 without the Braille number sign - SGD 10000: 7 without the Braille number sign 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Specialized coding scheme</p> <ul style="list-style-type: none"> - Adoption of Braille, a prominent writing/reading system specifically for the visually impaired - Modification of Braille codes, presumably to limit the number of characters <p>Adoption of Braille codes has been recommended by the Singapore Association of the Visually Handicapped.</p>






Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Malaysia</p> <p>https://www.bnm.gov.my/current-banknote-series</p> <p>https://banknotenews.com/?s=malaysia&submit=Search</p>	<p>Fourth Series (2009) <i>(In circulation)</i></p> 	<p>Braille marks are found only in one denomination (MYR 50), the first issued in the banknote series. Design elements feature stylized Braille points in the shape of diamonds.</p> <p>Tactile lines are found in the rest of the denominations of the same banknote series later issued in 2012. The denomination coding scheme employs variation of both frequency and orientation of the raised print.</p>	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme and using stylized Braille points.</p>





Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Canada</p> <p><u>Blind and Partially Sighted - Bank of Canada</u></p> <p>https://www.bankofcanada.ca/banknotes/bank-note-series/frontiers/</p>	<p>Frontiers Series (2011) (In circulation)</p> 	<p>Tactile feature consists of symbols of six raised dots (two columns of three). The number and position of these six-dot symbols vary according to the denomination:</p> <ul style="list-style-type: none"> - CAD 5: one six-dot symbol - CAD 10: two six-dot symbols - CAD 20: three six-dot symbols - CAD 50: four six-dot symbols - CAD 100: two symbols separated by a smooth surface that is wider than that on the CAD 10 note 	<p>This system is not Braille. It was developed in consultation with Canadians who are blind or partially sighted after research indicated that not all users read Braille.</p> <p>Compared with intaglio-printed tactile marks, these embossed features showed higher durability in several physical and chemical tests.</p>






Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>European Central Bank</p> <p>Source: For the visually impaired</p> <p>https://www.ecb.europa.eu/euro/shared/img/euro_banknotes_specimen_72dpi.zip</p>	<p>Europa Series (2013) (In circulation)</p> 	<p>Tactile marks at the edges of the note</p> <ul style="list-style-type: none"> - EUR 5 and EUR 50: slanted lines at both edges - EUR 10 and EUR 100: slanted lines at both edges, with an intermittent space - EUR 20 and EUR 200: slanted lines at both edges, with two intermittent spaces 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>The intaglio-printed tactile marks are to be used with the size variation to distinguish the denominations.</p>



Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>European Central Bank</p> <p>Source: For the visually impaired</p> <p>https://www.ecb.europa.eu/euro/shared/img/euro_banknotes_specimen_72dpi.zip</p>		<p>Tactile marks at the edges of the note</p> <ul style="list-style-type: none"> - EUR 5 and EUR 50: slanted lines at both edges - EUR 10 and EUR 100: slanted lines at both edges, with an intermittent space - EUR 20 and EUR 200: slanted lines at both edges, with two intermittent spaces 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>The intaglio-printed tactile marks are to be used with the size variation to distinguish the denominations.</p>
<p>Australia</p> <p>Source: RBA Banknotes: For the Vision Impaired Community</p> <p>https://banknotes.rba.gov.au/banknote-features/explore/</p>	<p>2016 issuance <i>(In circulation)</i></p> 	<p>Each denomination will have a different number of raised bumps.</p> <ul style="list-style-type: none"> - AUD 5: one bump on each of the long edges of the banknote next to the top-to-bottom window - AUD 10: two bumps on each edge - AUD 20: three bumps - AUD 50: four bumps - AUD 100: five bumps. <p>The location of the bumps means that they always appear slightly left of center on the top edge regardless of which way it has been placed in a wallet or purse.</p>	<p>The tactile bumps/dots are not Braille; these are created with an embossing stamp that “deforms” and pushes the polymer substrate to create the tactile mark.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Australia</p> <p>Source: RBA Banknotes: For the Vision Impaired Community</p> <p>https://banknotes.rba.gov.au/banknote-features/explore/</p>		<p>Each denomination will have a different number of raised bumps.</p> <ul style="list-style-type: none"> - AUD 5: one bump on each of the long edges of the banknote next to the top-to-bottom window - AUD 10: two bumps on each edge - AUD 20: three bumps - AUD 50: four bumps - AUD 100: five bumps. <p>The location of the bumps means that they always appear slightly left of center on the top edge regardless of which way it has been placed in a wallet or purse.</p>	<p>The tactile bumps/dots are not Braille; these are created with an embossing stamp that “deforms” and pushes the polymer substrate to create the tactile mark.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>
<p>United Arab Emirates</p> <p>Source: UAE Central Bank approves currency notes featuring Braille Banking – Gulf News</p> <p>http://www.banknote.wis COLLECTION/countries/ASI/UAE/UAE.htm</p>	<p>Dh5</p>  <p>Dh10</p> 	<p>Engraved in bleed-off intaglio printing on the edge of the banknotes’ short sides</p>	<p>These tactile lines are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>United Arab Emirates</p> <p>Source: UAE Central Bank approves currency notes featuring Braille Banking – Gulf News</p> <p>http://www.banknote.ws/COLLECTION/countries/ASI/UAE/UAE.htm</p>	<p>Dh20</p>  <p>Dh50</p>  <p>Dh100</p>   <p>Dh200</p> 	<p>Engraved in bleed-off intaglio printing on the edge of the banknotes' short sides</p>	<p>These tactile lines are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>United Arab Emirates</p> <p>Source: UAE Central Bank approves currency notes featuring Braille Banking – Gulf News</p> <p>http://www.banknote.wiki/COLLECTION/countries/ASI/UAE/UAE.htm</p>	<p>Dh500</p>  <p>Dh1000</p>  	<p>Engraved in bleed-off intaglio printing on the edge of the banknotes' short sides</p>	<p>These tactile lines are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>
<p>Pakistan</p> <p>Source: SBP says banknotes added with Braille features (thenews.com.pk)</p> <p>https://www.sbp.org.pk/finance/Pak.asp</p> <p>https://banknotenews.com/?s=pakistan&submit=Search</p>	<p>2006 issuance (In circulation)</p> <p>All currency notes of Rs20 and above have tactile features.</p> <p>Rs20</p> 	<p>Braille features on obverse to determine the denomination of the currency notes.</p> <p>Rs.20: one line Rs.50: two lines Rs.100: three lines Rs.500: one dot Rs.1000: two dots Rs.5000: three dots</p>	<p>This system is not Braille, but it uses raised dots and lines as tactile marks located at the lower left portion of the notes.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Pakistan</p> <p>Source: SBP says banknotes added with Braille features (thenews.com.pk)</p> <p>https://www.sbp.org.pk/finance/Pak.asp</p> <p>https://banknotenews.com/?s=pakistan&submit=Search</p>	<p>Rs50</p>  <p>Rs100</p>  <p>Rs500</p>   <p>Rs1000</p> 	<p>Braille features on obverse to determine the denomination of the currency notes.</p> <p>Rs.20: one line Rs.50: two lines Rs.100: three lines Rs.500: one dot Rs.1000: two dots Rs.5000: three dots</p>	<p>This system is not Braille, but it uses raised dots and lines as tactile marks located at the lower left portion of the notes.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>



Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Pakistan</p> <p>Source: SBP says banknotes added with Braille features (thenews.com.pk)</p> <p>https://www.sbp.org.pk/finance/Pak.asp</p> <p>https://banknotenews.com/?s=pakistan&submit=Search</p>	<p>Rs5000</p> 	<p>Braille features on obverse to determine the denomination of the currency notes.</p> <p>Rs.20: one line Rs.50: two lines Rs.100: three lines Rs.500: one dot Rs.1000: two dots Rs.5000: three dots</p>	<p>This system is not Braille, but it uses raised dots and lines as tactile marks located at the lower left portion of the notes.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>
<p>China</p> <p>Source: China issues new edition of renminbi bills, coins</p> <p>https://banknotenews.com/?s=yuan+note&submit=Search</p>	<p>Fifth series of renminbi (1999-2020) <i>(In circulation)</i></p> 	<p>Numbers in Chinese Braille at the lower right corner of the note.</p>	<p>These are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Banknotes are also discriminated by size variation.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>China</p> <p>Source: China issues new edition of renminbi bills, coins</p> <p>https://banknotenews.com/?s=yuan+note&submit=Search</p>		<p>Numbers in Chinese Braille at the lower right corner of the note.</p>	<p>These are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>Banknotes are also discriminated by size variation.</p>



Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Trinidad and Tobago</p> <p>Source: <u>The Polymer Series</u></p> <p>https://banknotenews.com/?s=trinidad+and+tobago&submit=Search</p>	<p>The Polymer Banknote Series (2019) <i>(In circulation)</i></p> 	<p>Tactile imprint at the lower right corner of the note.</p> <p>TTD 1: two vertical lines TTD 5: "L" shape TTD 10: "C" shape TTD 20: triangle shape TTD 50: circle shape TTD 100: "X" shape</p>	<p>This system is not Braille, but it uses raised dots to form tactile marks.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>India</p> <p>Source: https://paisaboltahai.rbi.org.in/</p>	<p>Mahatma Gandhi (New) Series (2016) <i>(In circulation)</i></p> <p>INR 10, 20, 50 – no tactile features</p> 	<p>Tactile lines, generally increasing with denomination, at the short edges of the note</p> <ul style="list-style-type: none"> - INR 100: four angular 'bleed lines' - INR 200: four angular 'bleed lines' with two circles in between the lines - INR 500: five angular 'bleed lines' - INR 2000: seven angular 'bleed lines' <p>Tactile 'identification marks' consisting of solid shapes at the right side of the note</p> <ul style="list-style-type: none"> - INR 100: triangle - INR 200: H - INR 500: circle - INR 2000: horizontal rectangle 	<p>Tactile features are printed using visible intaglio inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A combination of tactile lines and 'identification marks' is employed to increase accuracy in denominating banknotes.</p> <p>Banknotes are also discriminated by size variation. For lower denominations, only this accessibility feature remains useful for the blind.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Indonesia</p> <p>Source: https://www.bi.go.id/en/rupiah/gambar- uang/Default.aspx https://banknotenews.com/?s=indonesia&submit=Search</p>	<p>National Heroes Series (2016) <i>(In circulation)</i></p> 	<p>Tactile lines, decreasing as denomination increases, at the short edges of the note</p> <ul style="list-style-type: none"> - IDR 1000: 7 pairs of tactile lines - IDR 2000: 6 pairs of tactile lines - IDR 5000: 5 pairs of tactile lines - IDR 10000: 4 pairs of tactile lines - IDR 20000: 3 pairs of tactile lines - IDR 50000: 2 pairs of tactile lines - IDR 100000: 1 pair of tactile lines 	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Indonesia</p> <p>Source: https://www.bi.go.id/en/ruipiah/gambar-uang/Default.aspx https://banknotenews.com/?s=indonesia&submit=Search</p>		<p>Tactile lines, decreasing as denomination increases, at the short edges of the note</p> <ul style="list-style-type: none"> - IDR 1000: 7 pairs of tactile lines - IDR 2000: 6 pairs of tactile lines - IDR 5000: 5 pairs of tactile lines - IDR 10000: 4 pairs of tactile lines - IDR 20000: 3 pairs of tactile lines - IDR 50000: 2 pairs of tactile lines - IDR 100000: 1 pair of tactile lines 	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>
<p>Brazil</p> <p>Source: https://www.bcb.gov.br/en/banknotesandcoins/secondseriesreal https://banknotenews.com/?s=brazil&submit=Search</p>	<p>Second Series of Real (2010) <i>(In circulation)</i></p> 	<p>Tactile lines at the lower right corner of the note</p> <p>The denomination coding scheme employs variation of both frequency and orientation of the raised feature.</p>	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Brazil</p> <p>Source: https://www.bcb.gov.br/en/banknotesandcoins/secondseriesreal https://banknotenews.com/?s=brazil&submit=Search</p>		<p>Tactile lines at the lower right corner of the note</p> <p>The denomination coding scheme employs variation of both frequency and orientation of the raised feature.</p>	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Israel</p> <p>Source: https://www.boi.org.il/en/Currency/CurrentCurrencySeries/Pages/Default.aspx</p>	<p>Third Series of the New Shekel (2014) <i>(In circulation)</i></p> 	<p>Tactile lines, increasing with denomination, at the bottom left and right margins of the note</p> <ul style="list-style-type: none"> - ILS 20: 1 pair of tactile lines - ILS 50: 2 pairs of tactile lines - ILS 100: 3 pairs of tactile lines - ILS 200: 4 pairs of tactile lines <p><i>Magnified tactile lines for ILS 100:</i></p> 	<p>Tactile features are printed using transparent intaglio ink, whose relief may degrade as the notes are used in circulation.</p> <p>Incorporation of transparent features prevents unnecessary impact on the overall banknote design.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>


Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Poland</p> <p>Source: https://www.nbp.pl/ho-men.aspx?f=/bezpiecz-nepieniadze/wszystkie-banknoty_en.html</p>	<p>Modernised banknotes (2016) <i>(In circulation)</i></p> 	<p>Tactile open shapes at the bottom left corner of the note</p> <ul style="list-style-type: none"> - PLN 10: square - PLN 20: circle - PLN 50: diamond - PLN 100: symmetrical cross - PLN 200: triangle composed of small circles - PLN 500: two vertical lines composed of tiny squares <p>Tactile lines at short edges of the two highest denominations (PLN 200, 500)</p> <ul style="list-style-type: none"> - PLN 200: one set of tactile lines on each side - PLN 500: three sets of tactile lines on each side 	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A combination of tactile lines and shapes is employed to increase accuracy in denominating higher-value banknotes.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Poland</p> <p>Source: https://www.nbp.pl/ho men.aspx?f=//bezpiecz nepieniadze/wszystkie banknoty_en.html</p>		<p>Tactile open shapes at the bottom left corner of the note</p> <ul style="list-style-type: none"> - PLN 10: square - PLN 20: circle - PLN 50: diamond - PLN 100: symmetrical cross - PLN 200: triangle composed of small circles - PLN 500: two vertical lines composed of tiny squares <p>Tactile lines at short edges of the two highest denominations (PLN 200, 500)</p> <ul style="list-style-type: none"> - PLN 200: one set of tactile lines on each side - PLN 500: three sets of tactile lines on each side 	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A combination of tactile lines and shapes is employed to increase accuracy in denominating higher-value banknotes.</p>
<p>Banco Central de Honduras</p> <p>Source: Honduras 200 Lempira Banknote to Launch in September</p> <p>Honduras banknotes</p>	<p>200 Lempira</p>  <p>500, 100, 50, 20, 10, 5, 2, 1 Lempira</p>  	<p>Relief prints at the edges of the banknote (a pair of slanted lines) and Braille numbers at the lower right corner of the note.</p> <p>With bars for the blind, which are embossed prints located at the top and bottom edges of the note (the number of bars increases with the denominational value), and Braille numbers at the left side for denominations 20 Lempira and above, and at the right side for denominations 10 Lempira and below.</p> <p><i>Magnified transparent intaglio Braille mark for 1-Lempira:</i></p>  <p><i>* Braille mark codes for "1" and includes the Braille number sign</i></p>	<p>Ink registered Braille number "200" is quite small; intaglio relief prints at the short edges more likely to help the vision impaired.</p> <p>Braille numbers, which have no ink register, are quite small; bars for the blind feature at the long edges are not in the frequently touched portion of the note.</p>

Country/ Central Bank	Denominations/ Currency Series	Braille/Tactile Feature/Characteristics	Key Considerations/ Challenges
<p>Banco Central de Honduras</p> <p>Source: Honduras 200 Lempira Banknote to Launch in September</p> <p>Honduras banknotes</p> <p>https://banknotenews.com/?s=honduras&submit=Search</p>		<p>Relief prints at the edges of the banknote (a pair of slanted lines) and Braille numbers at the lower right corner of the note.</p> <p>With bars for the blind, which are embossed prints located at the top and bottom edges of the note (the number of bars increases with the denominational value), and Braille numbers at the left side for denominations 20 Lempira and above, and at the right side for denominations 10 Lempira and below.</p> <p><i>Magnified transparent intaglio Braille mark for 1-Lempira:</i></p>  <p><i>* Braille mark codes for "1" and includes the Braille number sign</i></p>	<p>Ink registered Braille number "200" is quite small; intaglio relief prints at the short edges more likely to help the vision impaired.</p> <p>Braille numbers, which have no ink register, are quite small; bars for the blind feature at the long edges are not in the frequently touched portion of the note.</p>

<p>Switzerland</p> <p>Source: Swiss National Bank (SNB) - The design of the new banknotes at a glance</p>	<p>Ninth Banknote Series (2016) (In circulation)</p>	<p>Tactile lines, increasing with denomination, at the long edges of the note</p> <ul style="list-style-type: none"> - CHF 10: 1 block of short, raised lines - CHF 20: 2 blocks of short, raised lines - CHF 50: 3 blocks of short, raised line - CHF 100: 4 blocks of short, raised lines - CHF 200: 5 blocks of short, raised lines - CHF 1000: 6 blocks of short, raised lines 	<p>Tactile features are printed using visible raised inks, whose relief may degrade as the notes are used in circulation.</p> <p>These are integrated into the banknote design by following the dominant color scheme.</p> <p>A simple logical coding scheme is adopted for ease of use.</p>
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Annex B
Braille numbers

Braille numbers are formed by placing the Braille number sign  (lead-in character for numerals) before the Braille letters "a" through "j".

Below are images of the Braille alphabet and Braille numbers for comparison.

Figure 1. The Braille Alphabet





































									
a	b	c	d	e	f	g	h	i	j
									
k	l	m	n	o	p	q	r	s	t
									
u	v	w	x	y	z				

Figure 2. The Braille Numbers

									
1	2	3	4	5	6	7	8	9	0

Source: <http://www.brailleauthority.org/learn/braillebasic.pdf>

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- BSP International Research Conference on "Revisiting Macro-Financial Linkages: Looking Back and Looking Ahead", 20-21 September 2016
- BSP International Research Conference on "The Evolving Role and Limits of Monetary Policy: New Perspectives for Emerging Market Economies", 28-29 October 2014
- BSP International Research Conference on "Contemporary Challenges to Monetary Policy", 28-29 February 2012
- 2010 Central Bank Macroeconomic Modeling Workshop, 19-20 October 2010
- BSP International Research Conference on Remittances, 30-31 March 2009
- Joint BSP-BIS High-Level Conference on Transparency and Communication in Monetary Policy, 01 February 2008