Tactile Graphic Production
Summary of Units 1 to 7 of the 2012 BANA Tactile Graphics Guidelines

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Criteria for Including a Tactile Graphic

- Tactile graphics and 3D models need to be introduced early in the process of learning braille.
- The required graphics need to be included in order for the tactile graphic to be considered complete.
- No diagram should be omitted if it is needed to make the tactile graphic comprehensible.
- Some complex diagram will never make meaningful tactile graphics.
- If an image is used to answer a question then a tactile graphic is needed.

Planning and Editing

- Would the information be more meaningful in text form?
- What information will be conveyed?
  - Identify the content that needs to be included.
  - Simplify the drawing.
  - Identify the components included in your graphics.
- Which production method will be used?

Design Principles

- A tactile graphic represent a print graphic. It is not an exact reproduction.
- Choose the most effective production medium for each graphic.
- Some eye catching design may be irrelevant to the concept(s) being taught.
- Position the tactile graphic as near to left margin as possible.
- A blank line is required before and after the tactile graphic.
- A print graphic may be simplified as long as the meaning of the graphic is not compromised.
- 3D graphics should be changed to 2D tactile graphics.
- Clutter should be avoided as much as possible.
- Lines for measuring should be the same length in the tactile graphic
- Use transcriber’s notes to announce changes made from the print graphic.
- When using transcriber’s notes, use the same vocabulary as the grade level student.
- Transcriber’s notes for students K-3 should be limited.
- Use a combinations of keys, symbols, and words to convey information.
- Maintain consistency.
- Age and experience of student must be considered when producing tactile graphics.
- Facing pages should be used when the key and graphic will not fit on one page.
Placement of Tactile Graphics

Definitions of Major Components:

- **Area**: represents a region that has specific importance in a tactile graphic. They are usually the concrete portions of a diagram.
- **Line**: represents linear information such as a river, geographic boundaries, or routes. They may represent either concrete or imaginary information.
- **Point**: indicates a specific place within the graphic.
- **Label**: may be words (alpha or numeric) used to identify an area, line, or point symbol.

Editing Content:

- Information on a tactile graphic should be selected based on the purpose of the graphic and what the reader is expected to gain from the graphic.
- The producer must read the text surrounding the graphic as well as the questions asked.
- A single graphic should contain no more than five different area textures, five different line styles, and five different types of point symbols.

Planning Process-Tactile Graphic Planning Sheet (Components)

- Title
- Method of Production
- Due Date
- Included Information (from surrounding text)
- Simplification/Elimination
- Re-sizing
- Consolidation and/or distortion
- Separation (List titles or heading for each part of the diagram)
- Transcriber's Notes
- Areas (Information, Texture, Material, Fill)
- Lines (Information, Texture, Material)
- Points (Information, Texture, Material)
- Alphabetic Key
- Numeric Key
Planning Size and Layout

- Consider the amount of space available within the size of page.
- Maximum width of a tactile graphic is 40 cells.
- Maximum length of a tactile graphic is 25 lines.
- Areas: minimum size is ¼ inch.
- Lines: primary lines must be minimum ½ inch.
- Dashed: primary lines ¼ to 3/8 inches
- Locational Lines: for tick marks on number lines and graphs must be ½ inch or a ¼ inch on each side of the line.
- Lead Lines: must be the least significant line in the graphic.
- Arrows: must be a solid or broken line with a solid triangle or open arrowhead.
- Grid lines: must be less significant than other information shown on the graph.
- Axis lines: should be stronger than grid lines and include an arrowhead.
- Point symbols: minimum diameter must be at least ¼ inch (6mm).
- Labels: should be placed a minimum of 1/8 inch (3mm) to a maximum of ¼ inch from any other component. A 1/8 inch blank space should be allowed on all sides of the label.
- Simplification: Be careful not to over simplify because it can detract from comprehending the intended purpose of the diagram.
- Elimination: Print information may be eliminated if it will not hinder the purpose. Secondary information may be included as a note or description in a transcriber's notes.
- Consolidation/Distortion: Combining may occur only if the original purpose is not hindered. (i.e. Indonesian Archipelago).
- Separation: To reduce clutter, complex diagrams should be divided into sections or separated into layers of information. When an illustration is separated, a few points of reference must be made available to help the reader understand how the separated parts fit together.

Braille Formats for Tactile Graphics

Placement of Tactile Graphics

- Illustration should be as close as possible to the corresponding braille text.
- A blank line proceeds and follows a tactile graphic.
- Numbering or lettering diagrams are presented vertically rather than side by side.
- For testing, answer choices need to be spatially arranged horizontally regardless of what is shown in print.
Order of Elements in a Tactile Graphic

- Tactile graphics may consist of some or all these elements:
  - Headings
  - Caption
  - Transcriber’s Notes
  - Key
  - Graphic
  - Source

- Each print graphic needs to be analyzed to decide how these elements may be presented to the reader in the most understandable order and format.

Headings, Titles, and Numbered Figures

Centered Headings (Heading Level 1)

- Used as the title of a tactile graphic.
- Blank line should be left before and after centered headings.
- When a tactile graphic extends beyond one page repeat the title.
- When there is no title to the print illustration do not add a title to the tactile graphic.

Running Headings (Title)

- It is located on the top of the page before centered heading.
- A blank line is needed before entering the centered heading.
- It is usually the title of the book (textbook).
- It is not needed on regular school produced tactile graphics.
- It must not occupy more than one line.

Cell-5 Headings (Heading Level 2)

- It is used sometimes with a key.
- It must be preceded by a blank line.

Illustration Captions

- Consists of any statement that is shown accompanying an illustration or its title.
- Transcriber's note symbols are not required.
- Do not leave blank spaces before and after a caption.
If extra information is needed that is not included in the caption, a transcriber's note is needed.

**Transcriber's Note: Content and Format**
- It is any general explanation written by the braillist about the illustration.
- A key list may be a part of a transcriber's note.
- Starts in cell seven with the transcriber's note symbol.
- Runover lines begin in cell 5.
- Notes should be short and concise.
- Written in the present tense and at the student's grade level vocabulary.

**Keys and Legends: Content and Format**
- Texture key lists are presented in this order:
  - Area textures
  - Line textures
  - Point textures
  - Alphabet textures
  - Numeric textures
- Texture, symbol, or key need to match the graphic illustration.
- Numbered keys should be placed in numeric order.
- Braille letting format should follow print format (i.e., capitalization).
- Transcriber's note need to use the word "key" even if "legend" is used in print.
- Use a key when space is prohibitive to include a label.
- Single letter keys are not recommended. If used, follow the letter with a period.
- Short-form words (2 or more braille cells) may be used in a key.
- Insert a key as a transcriber's note below the tactile graphic title.
- A blank line must follow a centered title before the beginning of a key.
- If possible, a key must appear on the same braille page with the tactile graphic.
- If not possible, a key is place on a page preceding the illustration.
- When a key is on a facing page, it should follow the title of the graphic.
- A multi-page key need to follow the page containing the graphic.
- Categories of items in a key must be listed in this order:
  - Texture symbols
  - Letter key symbols
  - Number key symbols
- Texture symbols start in cell 1 with the explanation starting in cell 6 and runover lines in cell 8.
• Point symbols are centered in the first four cells with the explanation starting in cell 6 and runover lines in cell 8.
• No blank line is needed between different types of symbols.
• Key sub-headings should be placed in cell 5 with runover lines in cell 5.
• Symbol Placement and Measurements in Key Areas
  o All area texture symbols begin in cell 1 and end in cell 4.
  o Texture symbols should be 1 inch long from left to right.
  o Area texture symbols in a key must match those on tactile graphic.
• Line symbols in a key must be 1 inch in length and match the texture on the tactile graphic.
• Point
  o Should be centered between braille cell 1 and 4 and align with the top edge of the braille cell (dots 1 and 4).
  o Should be a minimum of ¼ inch.
  o Must match those that appear on the tactile graphic.
• An alphabetic key must consist of two lower-case English letters.
• Single-cell braille contractions cannot be used as part of a 2-cell alphabetic key.

Label Placement
• Placed horizontally on the tactile graphic.
• Whenever possible labels for large areas or section need to be braille (or spelled) out.
• Combination of spelled-out words and alphabetic key symbols may be used.
• Lead lines may be used to connect labels to small areas.
• Capitalization of labels on the graphic should follow print (except in limited space).
• Letter sign is not required with capitalized letters but is required for uncapitalized letters.
• Labels placement needs to be at least 1/8 inch and no more than ¼ inch from corresponding component.
• Measurement line labels are placed beside the line.
• If text in a label is split between two braille lines, the runover line is left justified.
Mathematical and Scientific Diagrams

According to the Tactile Graphic Guidelines Unit 6-1:

Regardless of braille code used, the numeric indicator should be omitted when depicting measuring tools, number lines, and Cartesian graphs. It is not necessary to include a transcriber’s note regarding the omission of the numeric indicator.

If it is deemed necessary to omit the numeric indicator (for example, due to space constraints), the omission must be explained in a transcriber’s note prior to the graphic.

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<th>Use Numeric Indicator</th>
<th>Omit Numeric Indicator</th>
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Clocks

Analog Clock

- Numeric indicator should not be used.
- Clocks can be displayed with two clocks side-by-side followed by two more clocks side-by-side.
- Clock circumference should be tactually distinct from the tick marks.
• Tick mark length extends no less than 3/16 inch and no more than ¼ inch one either side of the circumference.
• Clock numbers are places outside of the clock, 1/8 inch from tick marks.
• The hour hand should be dotted, and the minute hand should be a smooth texture.
• When discerning minutes, clock face must be larger.
• Tick marks for minutes should extend 1/8 inch on either side of the circumference.
• Number placement in a tactile graphic 24-hour clock should be similar to the print one.

Digital Clock
• Perimeter of a digital clock is shown with the time brailed inside.
• Perimeter of clock is represented by a series of unspaced braille symbols for grades 4 and up.
  o Dots: 1234 Top left corner
  o Dots: 13 Top line
  o Dots: 1456 Top right corner
  o Dots: 456 Right side line
  o Dots: 3456 Bottom right corner
  o Dots: 36 Bottom line
  o Dots: 1236 Bottom left corner
  o Dots: 123 Left side line

Spinners
• If numbers are shown, they should be preceded by the numeric indicator.
• Outline of the spinner should be tactually distinct from the lines separating the sections.
• Pointer contains an arrow at the end.
• Tail should not be shown.
• Labels should be places 1/8 inch outside the outline of the spinner.

Circle Graphs
• If numbers are shown, they should be preceded by the numeric indicator (number sign).
• Pie charts should be shown a tactile graphic (not a list).
• Outline of the circle should be tactually distinct from lines separating the divisions.
• Labels should be placed 1/8 inch outside the circumference.
• If possible, place a key (if needed) on the same page as the graphic.
• If needing lead lines: they need to be ¾ in length (minimum) and 1 1/2 (maximum). Do not use arrows on the ends of lead lines.
Money

- Real money should be used when identifying coins.
- Print information should be transcribed in braille without interpretation.
- Letter can be used to represent coins, for example:
  - pn for penny
  - nk for nickel
  - dm for dime
  - qr for quarter
  - hl for half-dollar

Line Formations

Number Lines

- Number lines are used to teach relationships between numbers.
- A numeric indicator is not used before a number if it occurs below the number line.
- A numeric indicator is used before a number above the number line.
- Include arrowheads on the number line if shown in print.
- The number line should always start and end with an arrow or axis line.

Number Line Label Placement

- Scale mark (tick mark) and the first digit of its numeric label should be aligned.
- Radical sign (square root) should be aligned with the coordinate marker.
- Open fraction sign should be aligned with the coordinate marker.

Long Number Line Runover

- Start the number line at the margin
- Blank line is inserted between the exercise number and the number line.
- Break line segments between integers.
- Omit unused portions of the line.
- Runover lines should start in cell 3 with a coordinate marker.

Number Lines for Grades K-3

- Must be shown as a tactile graphic.
- When a line segment is bold, it should be tactually stronger than the axis line.
- Scale marks should be ½ inch long.
Number Lines for Grades 4-12

- Number lines may be prepared using braille symbols.
- Distinctive markers should be moved to the line above, directly over the scale marker.

Line or Dot Plots

- Line plots are formed by a series of stacked symbols (usually an "x").
- Line plots may not need to be prepared as a tactile graphic if possible.
- Follow print intention for placement of labels.
- Make as a tactile graphic if it is not possible to fit all the number line scale marks across the page.
- Symbols shown in print are replace by the full braille cell (dots 123456).

Box-and-Whisker Plots

- It is type of diagram or graph used to show the distribution of data.
- Keep the plot on one page if possible.
- The plot should be placed above the number line even if shown below in print.
- All plotted dots should be uniform in size.
- Be consistent in placement of the labels.
- The numeric indicator is used if the plot is identified with numbers.
- The plot should be a tactile graphic while the line graph is in braille.

Graphs and Graphing Components

Grid

- Grid lines should be the least distinct line in a graph.
- Squares of a grid should be no smaller than 3/8 inch.
- Some grid lines may be omitted if not necessary to the understanding of the graph.
- Add grid lines when the readers is required to track the values of a plotted point or bar.
- A shaded region in a graph should be clear enough to recognize but not so strong as to overpower the grid line, plotted items, or the axes.

Lines

- Scale marks (tick marks) must be ½ inch long and shown ¼ inch long on either side of a line.
• If tick marks are shown in print they must show in braille.
• Do not use lead lines.
• A “Zigzag” on a line to indicate omission in print should be included on the tactile graphic.

Labels
• Some numbers can be omitted from the horizontal and vertical lines if space is a premium.
• Use either even or odd number labeling.
• A transcriber's note is not necessary to explain the labeling of numbers.

Cartesian Graphs
• The numeric indicator should not precede the numbers on the x and y axis lines.
• Grid lines should be the least distinct lines on the graph.
• Axis lines should be tactually stronger than the grid lines.
• Tick marks on the horizontal and vertical axis lines may be the same line strength as the horizontal and vertical axis lines.
• Tick marks should cross the axis lines with ¼ inch on either side of the axes lines.
• Arrowheads are outside the boundary of the grid.
• Plotted lines should be the strongest and most tactually distinct lines on the graph.
• Plotted points on lines or objects must be distinct from the lines or objects on which they are placed. (about a 1/8 inch space around the point).
• Points should be no smaller than 1/8 inch in diameter.
• On the x-axis, dots 123 of the first digit of the number should align with the grid line or tick mark.
• On the y-axis, dots 25 should align with the grid line or the tick mark
• Point (0,0): Label number 0 or letter O. Place below the x-axis and to the left of the y-axis.

Plotting Figures
• Should be tactually distinct for the horizontal and vertical axis lines and grid lines.
• If possible, outline the shape of the figure rather than making it solid.
• If needed, use a distinct enough texture to avoid confusion between the grid.
• Do not place horizontal or vertical coordinate values inside a figure.
• Detailed print drawing should be simplified in the tactile graphic.
• To show direction of movement, use a line texture different from that used for horizontal and vertical axes.
**Line Graphs**

- A line graph is comprised of a horizontal and vertical axis labeled with a word or words(s).
- If the values are numeric, use the numeric indicator (number sign).

**Grid**

- If it is needed to tack the values plotted points, adding grid lines is allowed even if they are not used in the original print document.
- If grid lines are added, tick marks shown in print may be omitted.

**Key**

- A key to the different line textures should be placed before the graph.
- The key should be listed in the order the line appears from top to bottom or left to right on the graph.

**Lines**

- Grid lines should be the least distinct lines on the graph.
- x-axis and y-axis lines must be tactually distinct and stronger than the grid lines.
- If tick marks are shown in print then they should be shown in braille.
- Tick marks on the horizontal and vertical axis lines may be the same line strength as the horizontal and vertical axis lines.
- Tick marks should straddle the axis lines ¼ inch on either side of the axis lines.

**Labels**

- Heading label for the horizontal values should be placed below the values and should be left justified with the first cell of the first horizontal value.
- Heading for the vertical values should be aligned with the first cell of the first vertical values.
- On the horizontal axis, dots 456 of the first cell of the value should be lined up with vertical grid line or tick mark and be spaced 1/8 inch from the tick mark or axis line.
- It may be necessary to stagger the horizontal values.
- On the vertical axis, dots 25 should be aligned with the grid line or tick mark on the vertical axis line and be spaced 1/8 inch from the tick mark or axis line.
- No tick line is required for the (0,0) point.
- The plotted line should be the strongest and most tactually distinct line on the graph.
Scatter Plots

- Graph showing a set of points that are based on a pair of data.
- Use the numeric indicator.
- Reproduce the exact number of dots as is shown on the print document.
- There is no need to add the grid lines.
- Horizontal and vertical axis lines should be the same texture.
- Vertical axis labels to the left of this axis line need to be 1/8 inch away from that line.
- Horizontal axis heading labels should line up with the vertical axis line.
- Vertical axis heading labels can be placed to the left of and mid-way down the vertical axis line.
- Size of plotted points symbols will be determined by the spacing required between the plotted points.
- Do not use the 1/8 inch blank space around the points.
- Plotted points may overlap.

Bar Graphs

- A bar graph is one that uses the lengths of bars to represent the quantitative relationship between horizontal and vertical values.
- Orientation of the graph should always match that of the print unless it is impossible to do this.
  Use numeric indicators if the values are in numeric in the print version.
- Add grid lines that are perpendicular to the bars for easier tracking of values.
- If grid lines are added, tick marks can be omitted.
- A key to reference different bar textures should be place before the graph.
- Grid lines should be the least distinct on the graph.
- Axes lines are more distinct then the grid lines.
- Tick marks shown in print version should be displayed in the braille version.
- Horizontal heading labels should be placed below the values and should be left justified with the first cell of the first horizontal value.
- Vertical heading labels should be aligned with the first cell of the vertical values.
- Runover lines for both vertical and horizontal should be left justified on the next line (no blank space).

Histograms

- It is a bar graph that combines data into equal intervals.
• If values are numeric, use the numeric indicator.
• Shape of the print graphic display is important and should not be distorted in the tactile graphic.
• If the bars are horizontal, align the value at the left edge of the bar.
• No space must be left between adjacent bars as the data is continuous.

Graphing Calculators
• Calculator keys should not be reproduced as a tactile graphic.
• Tactile graphic representation of a print graphic must be produced.
• Print screen graphic that uses an "x" as a plotted point should be represented as a dot in a tactile graphic.
• X and Y axes lines should be clearly displayed in a tactile graphic.

Pictographs
• Pictographs represent numeric data through the use of pictures and/or partial pictures.
• Use the numeric indicator if the print version uses numbers.
• The explanation for a pictograph tells the number that each picture represents and is often placed below the graph in print. Move the explanation above the graph. Begin in cell 1 and use the wording shown in print.
• Print information should be transcribed in braille without interpretation because additional information may "give away" an answer.
• No frame is included in the braille version.
• Row heading must begin in cell 1 with runovers in cell 3.
• Guide dots may be inserted at the end of a row heading.
• One blank cell must be left between each picture or symbol.
• For K-3, pictographs must be produced as a tactile graphic.
• For grades 4 and up, simple pictographs may be embossed in braille rather than shown as a tactile graphic.
• Embossed braille pictographs can only be used when whole or half units are being represented.
• Whole units should be represented as a "for" cell (123456) and a half unit is represented by dots 123.
• When partial units are shown, a tactile graphic must be produced.
Counting Symbols

- Pictures to be counted.
- Grouping of object in the tactile graphic is in the same order as the print version.
- Picture representations should be represented by solid simple tactile shapes such as circles, squares, or triangles. Random order in pictures should also be displayed the same way in a tactile graphic.
- If an operation sign or comparison sign is shown, it should be placed so that the dot 1 or 4 is aligned with the top of the shape, and on the top row if more than one row is depicted.
- If there is an exercise identifier (number or letter), the picture object may start on the same line.
- For grades 4 and up:
  - A picture object can be represented by braille cells.
  - If the surrounding text or question refer to the actual print object, a note explaining the substitution is required.
  - Insert a transcriber’s note if there is no print explanation.
  - One blank cell must be left between the symbols.
  - When items are counted in groups, three blank cells between groups are required.
  - When the combination of symbols cannot be accommodated on one braille line, transition to another braille line may take the place of the required space.
  - Counting items can be represented by using the letters "on" for one, "tn" for ten, "hn" for hundreds, "th" (uncontracted) for thousands.
  - Group print representations in braille.
  - If there is an exercise identifier (number or letter), the braille symbols may start on the same line.
- For K-3:
  - Counting blocks should be shown as a tactile graphic.
  - If a sign of operation or comparison is shown, these signs should be placed so that the dot 1 or 4 is aligned with the top of the block and on the top row if more than one row of blocks is depicted.
  - A blank line must precede a follow spatial arrangement.
  - If there is an exercise identifier (number or letter), the picture objects may start on the same line.
  - Include a transcriber’s note if the tactile graphic will include more than one page.

Decimal and Fractional Representation.

- In K-3, concepts of decimals notation are shown as grids of 100 individual squares or 10 strips of 10, with various amounts of shading.
- Grids should be shown as tactile graphics.
- Squares should be no smaller than 3/8 inch on a side.
- Strips of 10 should be no smaller than 3/8 inch wide.
Operational signs should be placed so that the dot 1 or dot 4 is aligned with the top of the grid and on the top row if more than one row or grids is depicted.
A blank line must precede and follow this spatial arrangement.
Picture objects may start on the same line as the exercise identifier.
A transcriber's note is needed if there is more than one braille or tactile graphic page.

Specialized Graphics

Thermometers
- A thermometer is a piece of equipment that measures temperature.
- A numeric indicator is not used on the values.
- The degree symbol in braille may be shown as a heading above the list of values.
- It is not necessary to show the whole span of the thermometer in one graphic.
- It is permissible to enlarge the thermometer.
- Frames around a thermometer should be omitted.
- Thermometer tube should be a minimum of 3/8 inches wide.
- Place tick marks on the left outside of the tube.
- Other labels need to be on the right outside of the tube.
- If print shows increment scales on both sides, the tactile graphic version should only show it on the left side.
- Place the tick marks no closer than 1/8 inch apart.
- Reduce the number of labels to show only the major increments.
- There should be 1/8 inch between the labeled values and the major tick marks.
- Values on the left side of the thermometer should be right aligned. Values on the right side of the thermometer should be left aligned.

Measurement Tools
- Actual braille rulers and protractors with raised marks do not register small values.
- Numeric indicators (number signs) are not shown with numbers on actual braille rulers or protractors.
- Tactile graphic representations should not show numeric indicators.
- Small increases in size may occur due to the production method, especially when using thermoform and micro-encapsulated devices.
- When the user needs to measure the tactile graphic, be sure to produce tactile graphics with adequate line strength and distinction.
The object to be measured must be greater than ¼ inch or have an angle greater than 5 degrees.

Proportions must be accurately reproduced in the tactile graphic.

Objects to be measured must not be altered in the tactile graphic.

An object to be measured must be raised at least to 1/32 of an inch.

If an object to be measured is less than ¼ inch it should be enlarged in whole number increments. A transcriber’s note is needed to explain this situation.

Raised dots or point located at the ends of a measuring line should not be pronounced enough to interfere with the part of the line that is to be measured.

Rays of an angle to be measured by a braille protractor need to be at least three inches long.

Rays of an angle need to be distinct enough (1/32 inch) for measuring.

Allow at least one inch on both sides of the angles to allow room for the placement of the braille protractor.

Tactile graphic of the braille ruler:

- It is permissible to enlarge the ruler and object proportionately to show the smaller increments if need be.
- Whole number tick mark increment are longer than fractional tick mark increments.
- Dots 123 of the first digit of the number should align with the tick mark and is placed 1/8 inch from the tick mark.

Angles to be measured using a tactile graphic of a braille protractor:

- It is permissible to enlarge the diagram of the object and protractor in order to show smaller increments.
- Tick marks denoting major degree marks must be longer than those for the minor degree marks.
- Numbers on the protractor should be placed both inside and outside the circle as space allows.
- Label should be between 1/8 to ¼ of an inch from the tick mark.

Two and Three Dimensional Drawings

- Tactile graphic need to large enough for the reader to interpret the details.
- Lead lines should be avoided as possible.
- Labels can be keyed if space is prohibitive.
- Measurement lines need not be shown if it is possible to label the line.
- If measurement lines are used the line should meet the end point perpendicular line. Do not user arrowhead end points.
- Total length of end point lines is no less than 3/8 inch and no more than ½ inch.
Simple Geometric Shapes

- A distinct line texture should be used to separate a shape from the surrounding material.
- Simple shapes should be shown as solid objects.
- If it is enlarged, the print proportion must be retained.
- Plotted point on lines or objects need to be distinct from the lines or objects on which they are placed.
- Labels should be placed outside the shape.
- Lengthy labels should be keyed.
- In braille, the degree symbol may be omitted but a transcriber’s note must state that the print angles are indicated in degrees.

Nets

- A net is a pattern that can be cut out and filed into a three-dimensional figure.
- If enlarged, the print proportions must be retained.
- Solid lines should be used to represent the outside edges.
- Folded lines should be tactile distinct from the outside lines.
- Tab areas (gluing part) should be areas of texture on the tactile graphic.

Venn Diagrams

- Is made up of two or more overlapping circles. Use to show relationships between groups of items sharing common properties.
- Use the numeric indicator if the values are in numbers.
- It is helpful to differentiate between each circle by having lines textures that tactually distinct for one another.
- Labels must be centered within the overlapping circle as shown in print

Tessellations

- It is an arrangement of shapes that forms a repeating pattern.
- Complex patterns should be simplified and enlarged.
- A shape’s boundary should not be made as a raised edge and overlap into the next shape.

Stem-and-Leaf Plots

- It is a method of showing data distribution.
- It should not be produced as a tactile graphic.
• It should only be produced in braille.

Chemistry
• When necessary show lead line, directional arrow, horizontal braces { } and/or brackets [ ].
• Embossed symbols for arrows must not be used.
• When arrows show direction and/or lead from and to operation arrows, a tactile line with an arrowhead must be used.
• If an arrow is used to show the direction of an electron, an arrow head must be used.
• When a brace is used to join a portion of a molecule to its label, a tactile brace must be used.
• When a bracket extends through bonds, a tactile bracket must be used.
• Make sure the labeling does not interfere with the molecular structure.

Complex Diagrams

Characteristics of a Complex Diagram
• A complex diagram must be made simple.
• There are too many specified areas to represent tactually.
• There are too many line styles (more than five).
• There are too many labels required.
• There is too much explanation required to be understood.
• Print diagram is in 3D.
• There is too much information spread out on large area.

Procedure
• Determine the main purpose of the diagram.
• Find out if the diagram is an essential part of the surrounding text.
• Determine if the original print serves as a visual decoration or is important to the subject matter.
• Find out if the user is to determine information or make specific observations from the print illustration as oppose to just describing the diagram to get the information needed.
• Determine if the print graphic is required in a testing situation.
Design Techniques

- Simplify
- Eliminate
- Consolidate and Distort
- Separate
- Consider using textures when 2 or 3 cell keys or labels do not fully convey where spatial information is located.
- Consider whether using full labels instead of 2 or 3 cell key abbreviations.
- Retain features that can be used as points of reference.
- Try writing lengthy information in a key rather than in a transcriber's note.
- Choose an alphabetic key instead of a numeric key.
- When possible, key pages should be placed on facing pages.
- If possible, when there are more than 5 area textures, lines or points, the diagram may have to be separated into sections.

Order of Preference for Modifications

- Move some information to the previous page.
- Delete one or more labels by writing a description in a transcriber's note.
- Delete the repeated heading on the diagram page.
- Make graphics smaller, if possible.
- Delete blank lines between "key:" and the key listing.
- Put the key listing into a column form.
- Reduce the space between the text and the graphic.
- Delete the running heading (unless required by the production agency)

Biology Illustration Questions When Producing a Tactile Graphic

- What information will be conveyed?
- On simplifying the drawing:
  o Can any part of the drawing be eliminated?
  o Can some other parts be described in transcriber's notes?
  o How will the graphic be presented?
  o Will the graphic be separated into more than one section?
  o Does the graphic need to be enlarged?
- Identify components to be included in the graphic:
  o Will the print labels fit in the available especially or will a key be required?
• What keying technique will be used?
• Which production method will be used?

Social Studies
• If water is shown in print, a background textures is used and it must be consistent throughout the tactile graphic.
• Scale need to be proportionately enlarged to the same degree as a the map.
• If it is not necessary to measure, the scale may be omitted.
• Scale may be placed at the end of the key.
• When the tactile graphic have more than one key page, the scale may be placed before the beginning of the key.
• If a map refers to direction or if the compass is being taught, a compass tactile graphic needs to be included.
• Compass rose arrows need to be in line with the longitude and latitude lines.
• If a compass is included, it needs to be simplified and placed consistently in the top left corner of the page.
• The letter sign is not included when labeling compass directions.
• Show only four directions on a compass for students K-3.

Step-by-Step Process for Map Illustrations When Producing a Tactile Graphics:
• What information will be conveyed?
• Simplify the drawing.
• Identify components to be in the graphic.
• Which keying technique will be used?
• Which production method will be used?

Charts and Graphic Organizers

Organizational Charts
• Try to make an organizational chart into a tactile graphic.
• Alphabetic or numeric keys may be required.
• Connecting lines should be a different texture than the lines representing the blocks.
• Labels are placed inside the boxes or circles.

Schematic Drawings
• Explains how something works by showing the relationships between its parts.
• Should always be presented as a tactile graphic.
- Should be simplified and keyed.
- All tactile graphics must be tactually recognized and remain consistent within a drawing or set of drawings.
- Lines that cross each other, but do not connect, must clearly be shown tactually by using different textures.

**Graphic Organizers**
- These are tools that facilitate the visualization of concepts, relationships, and facts.
- A tactile graphic needs to be produced.
- No blank spaces are required between connecting lines and boxes or circles.
- Labels for graphics organizers are placed inside the boxes or circles.

**Flowcharts**
- Flowcharts show how steps in a process fit together.
- Boxes in a tactile graphic must appear in the same sequence as in the print illustration.
- A tactile graphic of the print flowchart structure should precede the transcription of the text.
- If numbers are not assigned to the print shapes, the tactile graphic shapes should be labeled with transcriber-assigned alphabetic or numeric key symbols.
- If there is an explanation on the print flow chart, the tactile graphic need a similar explanation at the same point on the tactile graphic.
- Any special shape shown in the print illustration has to include a similar shape on the tactile graphic.
- For grades 1 through 4:
  - The flowchart should be produced similar to the print format.
  - Shape design used in print need to have similar shape designs in a tactile graphic.
  - Fit the entire graphic (if possible) on one braille page.
- For grades 5 through 8:
  - Keys can be used to explain parts of the diagram.
  - There must be a special symbols page showing all shapes, indicators, and symbols used.
  - Subsequent flowcharts may be transcribed without tactile graphics.

All information has been paraphrase from the Guidelines and Standards for Tactile Graphics [http://www.brailleauthority.org/tg/web-manual/index.html](http://www.brailleauthority.org/tg/web-manual/index.html)