



# 2015 Southwest Orientation and Mobility (SWOMA) Conference

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## Vector Line Drawing Tactile Maps

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3:00 – 4:30 PM

Presented by

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Developed for

Texas School for the Blind & Visually Impaired  
Outreach Programs



# Orientation and Mobility: Computer-Generated Production

## University of Oregon Study on Standardizing Tactile Graphic Maps

Department of Geography: Spatial and Map Cognition Research Laboratory



Figure 1: Screen Shot of the Department of Geography Faculty Projects at the University of Oregon

The University of Oregon Geography Department partnered with some 20 Orientation and Mobility Specialist throughout the state of Oregon and developed a list of tactile symbols representing different roadway infrastructure objects. Below is a list of the objects used in developing computer-generated line drawing maps.

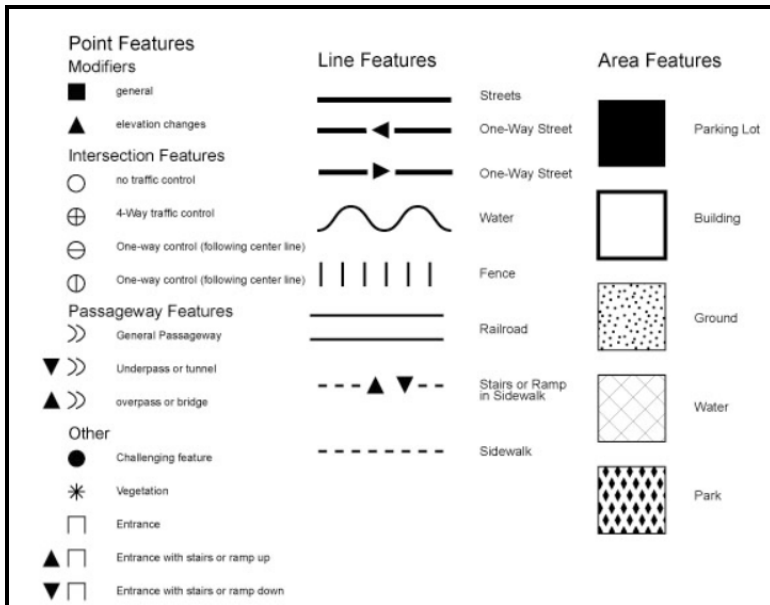


Figure 2: Screenshot shows 26 map symbols divided into the categories of points, lines, areas.

Location of the Tactile Graphic Symbols: <http://geog.uoregon.edu/maps/symbols.html>

Reasons for producing tactile graphic maps (Lobben & Lawrence, 2012):

- Produce tactile maps for areas that are off-network, such as indoor locations, parks, no-street networks (campus, complexes, etc.)
- Provides the user with a "bird's-eye view of an environment, allowing the user to develop a spatial understanding of the area.
- It makes the user into an "active" explorer rather than a passive participant in the navigation task (GPS will tell you where to turn, proceed, etc.).

According to a study, sighted participants, who use assistive technology during navigation exercises perform significantly worse on post navigation spatial knowledge acquisition tasks than do people who used maps during the same task (Parush, Ahuria, & Erev, 2007; Ishikaw et al. 2008).

According to another study by Dr. Amy Lobben, the actual use of the tactile map for real-world navigation task may develop a more complete mental map of an environment. It was concluded that if a student uses a tactile map along with orientation and mobility instruction, their spatial and environmental learning could be significantly enhanced (Lobben & Lawrence, 2012).

# BANA Guidelines and Standards for Tactile Graphics, 2010

## Unit 8 Orientation and Mobility

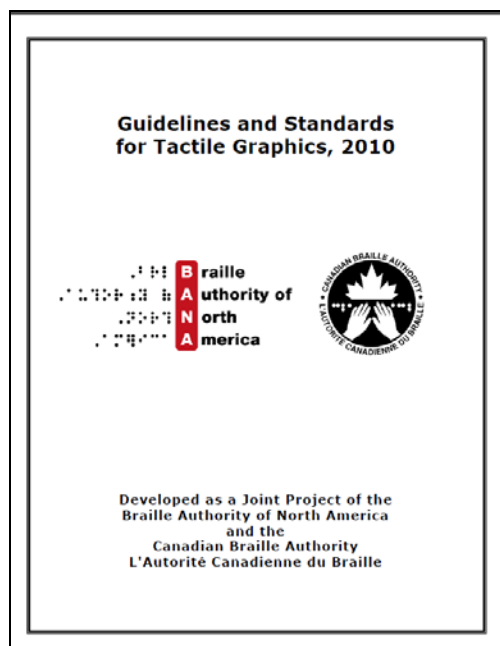


Figure 3: Screenshot shows the front cover of the PDF file on the BANA Tactile Graphic Guidelines publication.

Online Version: <http://www.brailleauthority.org/tg/web-manual/index.html>

PDF and HTML Version: <http://www.brailleauthority.org/tg/>

### Tactile Graphic Standards

- Points Types/Sizes
- Line Weights
- Label Placements
- Area Fill-Patterns

### General Guidelines and Standards:

- They should be very specific to the environment being mapped.
- A map too complex might be beyond the reader's skill level which could render it useless.
- Detailed or complex maps need to be simplified.
- There could be a series of maps for one route.
- Line drawing maps can be used to plan routes and navigate along walking paths.
- All items can be represented by using various area (shapes), lines, and points.
- Maps should be designed by an Orientation and Mobility Specialist.
- A tactile graphic map should always be aligned with the four cardinal directions.
- If wanting to indicate direction, a simple arrow pointing north with the letter "N" at the end of (above) the arrowhead is sufficient. A full compass rose is not needed.
- Map keys should be shown before the map and clearly displayed. It should explain the various textures and tactile symbols included on the map.

## Readability:

- Symbols should be easy to discern both tactually and visually from their background.
- Symbols or labels should be placed no closer together than 1/8 inch.
- Maps containing different areas need to have distinctly different patterns.
- There needs to be varied contrast between areas.
- The maps need to be simple.

## Object specifications for computer-generated maps:

- Use only circle, square or triangle for point landmarks.
- Use only 1pt., 3pt., or 6pt. line weights for streets and buildings.
- Use only 3pt. dash line for planned routes or sidewalks.
- Use only three fill patterns (solid black, solid white, and one textured) for areas.

## Environmental Features Included on a Tactile Map

Grass	Sidewalks
Streets	Boulevards
Ramps	Fences
Parking Lots	Stairs
Train Stations	Bus Stops
Entrances	Subway Stops
Buildings	Surface Textures
Intersections	Railroad Tracks
Parks	Bathrooms
Direction Indicators	Water

## Low Tech Instructional Teaching Aids

- Picture Maker: Wheatly Tactile Diagramming Kit
- Chang Tactual Diagram Kit
- Intersections: Cook Tactile Orientation and Mobility Kit.

## Microsoft Word Vector Drawing

The drawing feature in Microsoft Word (2010, 13, and 16) contain tools that are capable of producing "scalable vector" objects, such as lines, shapes, points, and textboxes. These objects are drawn and positioned to represent streets, buildings, sidewalks, open areas, and many more. "Scalable" means the lines can be drawn according to thickness, or "line weight". Three line weights can be used on a tactile graphic map (1-point, 3-point, and 6-point). Busy streets are 6-point lines while 3-point lines are neighborhood or light-duty streets. Below are the 17 drawing tools used to draw tactile graphics diagrams.

### Drawing Tools Needed on the Quick Access Toolbar

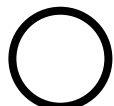
1. **Grid Settings:** Configuration Dialog Window for the grid guidelines.
2. **View Gridlines:** Activates/deactivates the grid guidelines on the document.
3. **Shapes:** Includes lines, arrows, geometric shapes, and unique shapes.
4. **Shape Fill:** Fills the selected object with a color, gradient, picture or pattern.
5. **Shape Outline:** Specifies the color, width, and line style of a selected shape.
6. **Outline Weight:** Provides a choice of line and border thickness.
7. **Dashes:** Provides a choice of lines for drawing.
8. **Arrows:** Provide a choice of types and directionality of arrows lines.
9. **Bring Forward:** Moves a selection one object layer forward. Get the pull down arrow icon.
10. **Send Backward:** Sends the selected object behind all other objects. Get the pull down arrow icon.
11. **Rotate:** Rotates or flips a selected object.
12. **Group:** Mends a set of objects into one object.
13. **Ungroup:** Breaks an object into separate individual objects.
14. **Regroup:** Re-mends a set of objects into one object.
15. **Draw Text Box:** Inserts a textbox into a document.
16. **Fill Pattern:** Fills a selected shape with a grayscale or color pattern.
17. **Select (Arrow):** Select text and/or objects on a document for grouping.

## Traffic Control Circles

Much information needs to be conveyed to the student at street intersections. Below are four possible traffic control scenarios students may encounter at an intersection. These circles are placed at street intersections with about a .13" space from the circle border to the start of a line (street or sidewalk).



- Intersection with east/west traffic control
- .5" circle with 3 point line weight border
  - Vertical 3 point diameter line



- Intersection with no traffic control
- .5" circle with 3 point line weight border
  - No diameter lines



- Intersection with north/south traffic control
- .5" circle with 3 point line weight border
  - Horizontal 3 point diameter line



- Intersection with total four way traffic control
- .5" circle with 3 point line weight border
  - Vertical and horizontal 3 point diameter lines



- Intersection consisting of a roundabout control
- .5" circle with a 3-point line weight border
  - Inter-circle is .375" diameter placed at center of .5" circle at 3-point line weight



## Street Access

### Infrastructure Lines and Objects

Keep lines clean on a tactile graphic. DO NOT use double lines to indicate a busy street unless it is a boulevard (two separate streets).

Major Thoroughfare (Busy Street) - 6 point line weight



Light-Duty (Neighborhood Street or Indoor Walking Path Hallways) - 3 point line weight



One Way Street - solid black fill triangle with a 6 point white border



Waterway: River/Creek (Curved Connector Grouped together as one object, 6 point line weight)



Railroad Track (Cross hash 3 point line weight)



## Walkway Access

Sidewalk or Indoor Rout lines (Small Dash Lines at 3 point line weight)



Sidewalk Ramp Drop Off (.25" squares)



Place Name Symbols – Point of Interest (all are .25" objects)

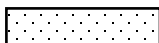


## Area Patterns

Buildings



Grounds/Parks/Open Spaces



Parking Lots



## T Intersection

### One Point Traffic Control Residential Neighborhood



Figure 4: Caption: Photo of a t-intersection: The northbound street t's into the east/west street. A stop is on the northbound street (traffic control). The east/west street has no sidewalk on the north side. It does have sidewalks on the south side. The northbound street has no sidewalks.

- Two residential streets.
- One street terminates into the other street.
- Traffic control is on the terminated street.

## Line Drawing Map

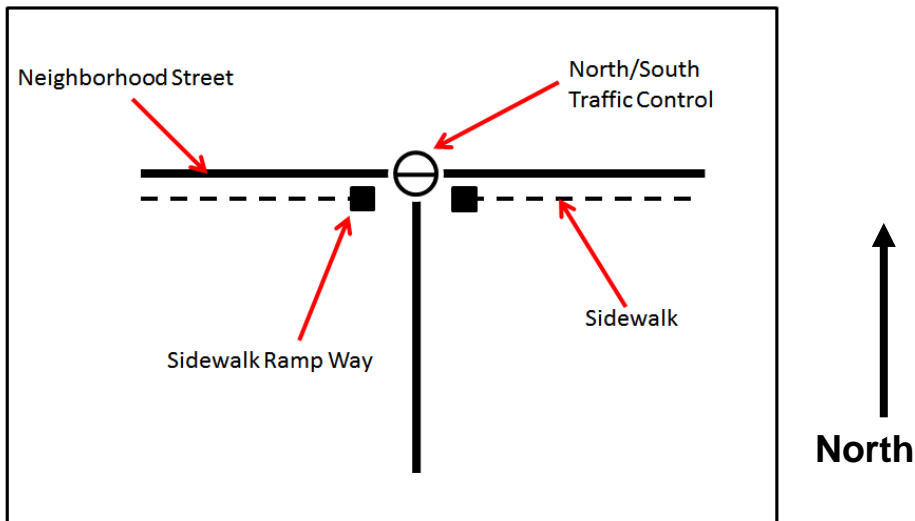


Figure 5: Caption: Print Line Drawing of the a Tactile Graphic Map showing a T-intersection in neighborhood street with a North/South traffic control, sidewalks, and sidewalk ramp way markings. Line drawing consists of a 3-point line east/west street. A traffic control indicates a north/south control. Two sidewalk ramp symbol (squares) are placed on the east and west side of a northbound 3-point line street. Text box indicates "north" pointing toward top of the page.

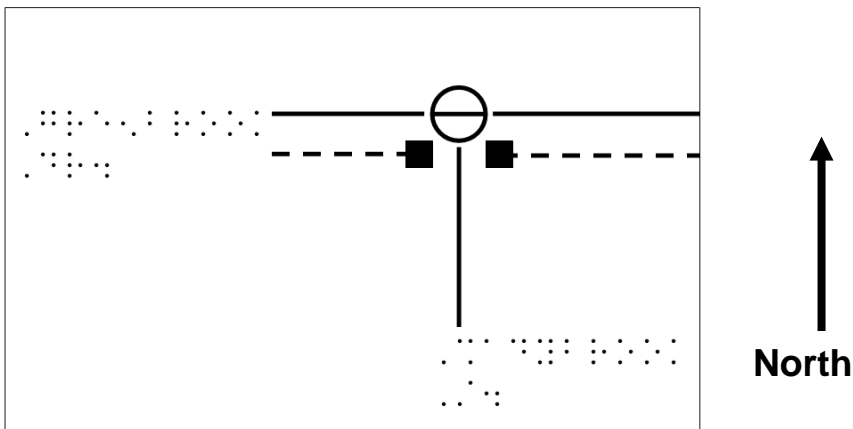


Figure 6 The same intersection as above with braille notation. Street names are placed on the south and west end of the streets. A line drawing map displays the street names. One is on the west side of a 3-point line street. Another is on the south side of a 3-point line street.

## Drawing Guidelines

- Traffic control symbol shows the north/south traffic is regulated.
- Traffic control symbol should have a .5" diameter.
- There is only one sidewalk available (southside of the east/west bound street).
- Sidewalk has ramps seperated by the north/south street.
- Both streets should be 3 point line weights.

## Busy Intersection with a Residential Street

- The residential street ends at a thoroughfare.
- Traffic controls are four points.
- Sidewalks exist on both sides of the street.
- No ramps exist.
- Houses are on both sides of the north/south residential street.
- No houses are on the busy street.
- No sidewalk are on the southside of the busy street.
- T-intersection is a total traffic control intersection.

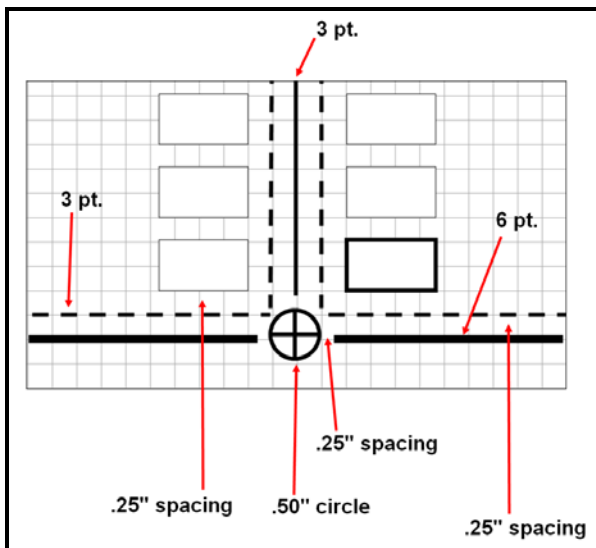


Figure 7: Print Outline Diagram of a busy intersection with a residential street showing Line Labeled with Line Weight Points. A line drawing maps shows different line weights for streets. 6-point is a busy street. 3-point is a light-duty street. Sidewalks are a 3-point line. The circle diameter of a traffic control is .5". Space between objects is .25".

## Drawing Guidelines

- All spacing between objects need to be about .25"
- Traffic control indicator circles are .50" in diameter.
- Sidewalks are 3 point dash lines.
- Start point house is a rectangle with 3 point line weight borders.
- All other houses are 1 point line weight.
- Major street is 6 point weight.
- Residential street is 3 point weight.
- Microsoft Word gridline line spacing setting should be at .25" for drawing objects and .125" for label placement.

## Labels

- Braille labels are always placed horizontally across the map and read left to right.
- On north/south running streets, labels are placed on the lower (south) end point of the street.
- On east/west running streets, labels are placed on the left (west) end point of the streets.
- Use two letter abbreviation (include at least one strong cell letter) for long word labels and must be represented in a key.
- Object labels on the map need to be no more the 1/8" from the first letter of the label to the start of the object.
- Swell braille and Tiger braille font size is set at 24 point. Plan all label placements on a map using this font size.

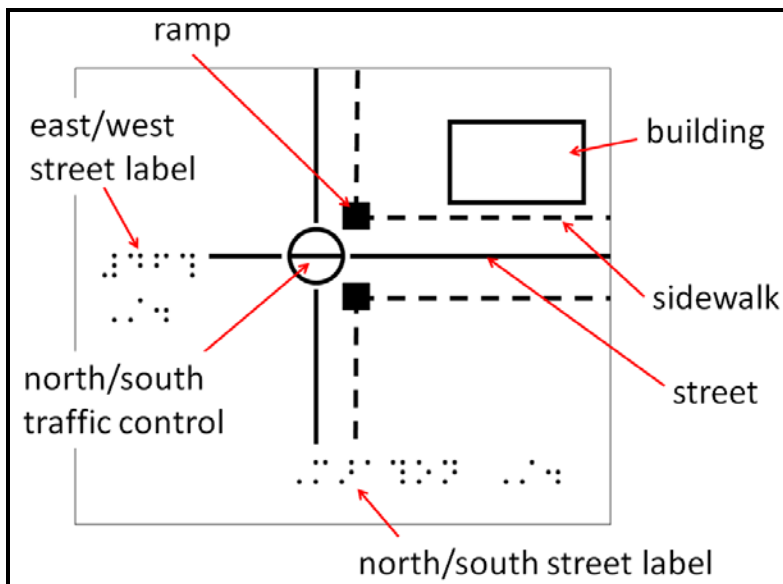


Figure 8: Print Outline Diagram with Objects Labeled. Line drawing shows where labels are placed on a tactile map. The map also identifies certain elements on the line drawing such as ramp, street, building, traffic control and sidewalk.

## Label Placement

Normally labels should not be placed inside objects, however if placement does not interfere with the objects, you can take a chance. If they need to be placed inside objects then a two-letter (lower case) abbreviation is needed with a transcriber's note and key identifying the letter combinations.

## Indoor Route

The below illustration displays a section of a school with part of a north/south hallway intersecting an east/west hallway. There are eight classrooms with room number labels inside each rectangle object (classroom).

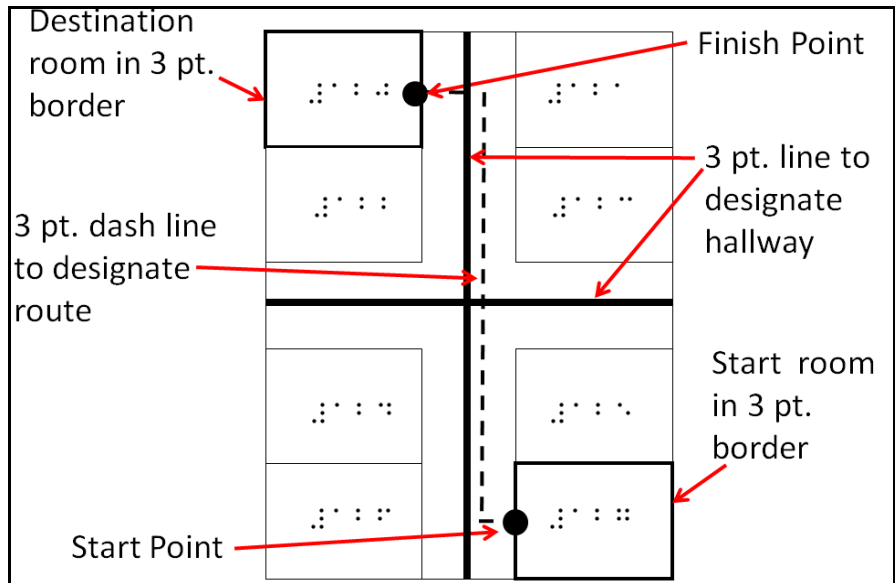


Figure 9: Print Outline Diagram depicting a School Hallway with Elements Labeled. Labels are explained below. Line draw indicates a hallway in a school that shows eight classroom all number rooms in braille. It also shows a route, indicated by a 3-point dash line, starting on a right side classroom up to a left side classroom.

The hallway has 3 point lines down the middle of each, indicating that these areas are public walkways (traffic area). Notice the route line (dash line) is located on the right side of the hallway. This indicates to the student that he needs to walk on the right side of the hallway. The point markers (start and finish) are .25" diameter solid black points. The destination room and start room are highlighted by a 3 point line weight border. Other rooms (not highlighted) consist of 1 point weight lines.

## Street Campus Route

Close-in campus street map guides are unique and different than public street arrangements. Special landmarks are featured on almost every block. Traffic is usually not heavy unless a regular city street straddles the campus. Building keys need to be use. These maps can clutter with detail information very easily. Readability can be compromised unless information is divided into sections. DO NOT scale back dimensions of the objects just so they can "fit" in a tactile graphic map. Keep all labeling in the correct placement as possible (north/south: bottom and east/west: left side). These maps can be representations of: schools, amusement parks, zoos, pedestrian malls, shopping districts, complex districts, and many more.

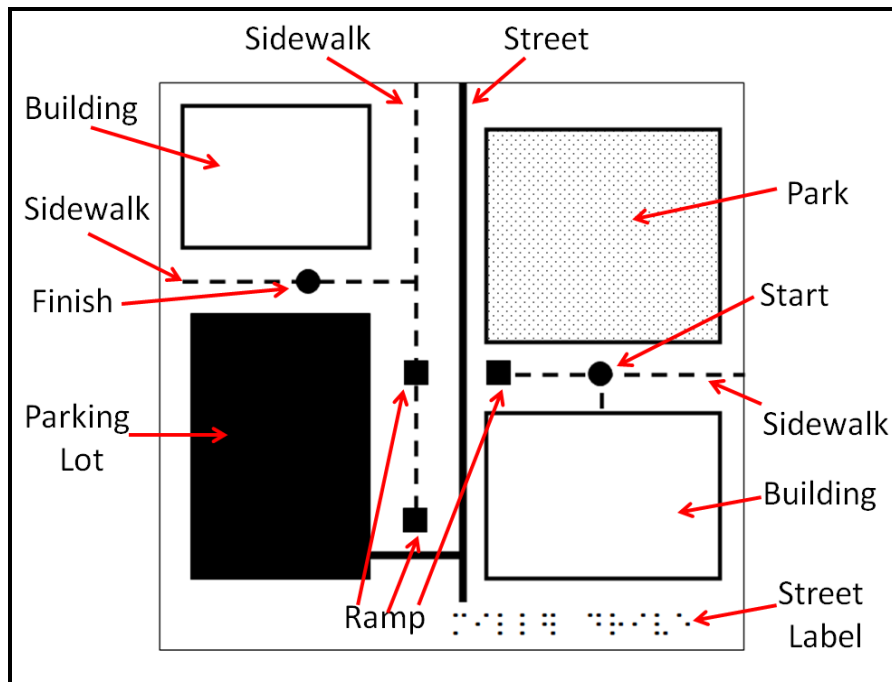


Figure 10: Print Outline Diagram of a School Campus with Elements Identified by Labels. Line drawing includes a 3-point street, east/west sidewalks, a parking lot, 3 ramps, a street label, 2 buildings, a park, and start and finish points

# Instructional Routes for Concept Development

## (1) Ramp to Sidewalk Intersection



Figure 11: Photo shows a school sidewalk with a red arrow indicating a ramp and another red arrow indicating a sidewalk intersection.

## Ramp to Sidewalk Intersection

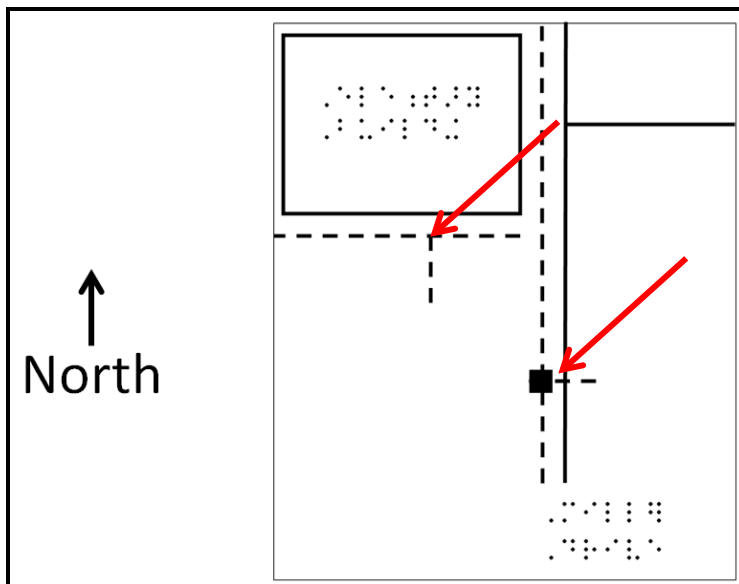


Figure 12: Print outline drawing represents a school sidewalk and building. A braille label is located on the bottom right side of the document. Line drawing shows a 3-point dash line as sidewalks, 3-point solid lines as streets, a building identified in braille, and two red arrows indicating a start and finish points on a route.



## (2) Crossing the Street with 2 Ramps

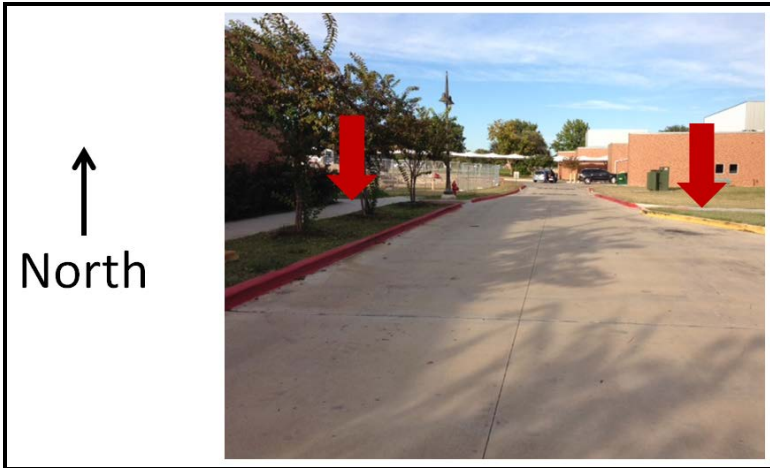


Figure 13: Photo shows a service road and two sidewalks. There are two red arrows indicating the east/west crossing areas of the sidewalk with the service road between.

## (2) Crossing the Street with 2 Ramps

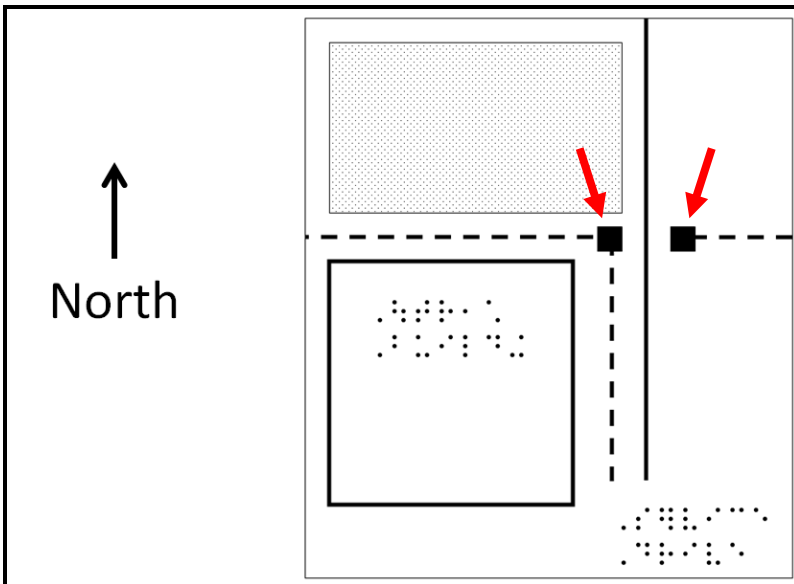


Figure 14: Print line diagram includes a service drive on a school campus. Line drawing shows a 3-point line street, 3 3-point sidewalks, two ramps symbols, two red arrows indicating the ramps. A building is identified in braille. The street is identified in braille.

### (3) Short L-Route with Three Ramps and Street Crossing



Figure 15: Photo shows two red arrows indicating ramps at sidewalks stop points.

### (3) Short L Route with Three Ramps and Street Crossing

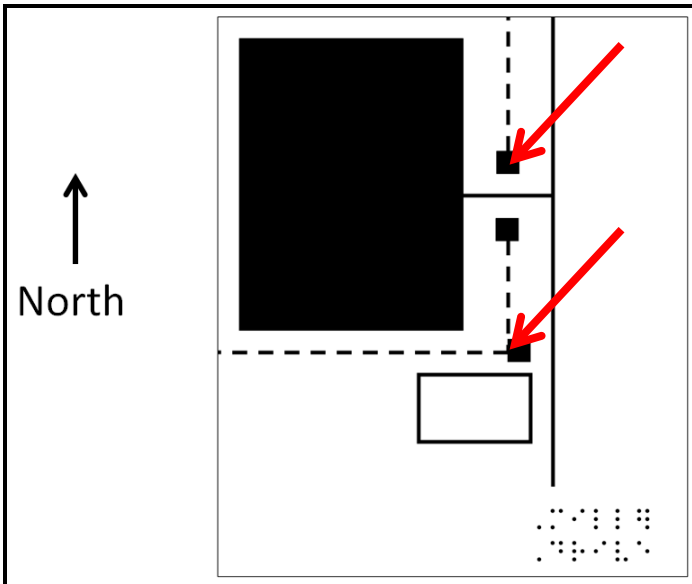


Figure 16: Print outline drawing shows parking lot, sidewalk dash lines, a small building, and a street identified with a braille label. Red arrows indicate two ramps symbols as sidewalk stop points

#### (4) Long L-Route with One Street Crossing and Three Ramps



Figure 17 Photo shows a street between a building and a parking lot with red arrows indicating ramps at the sidewalk stop points.

#### (4) Long L-Route with One Street Crossing and Three Ramps

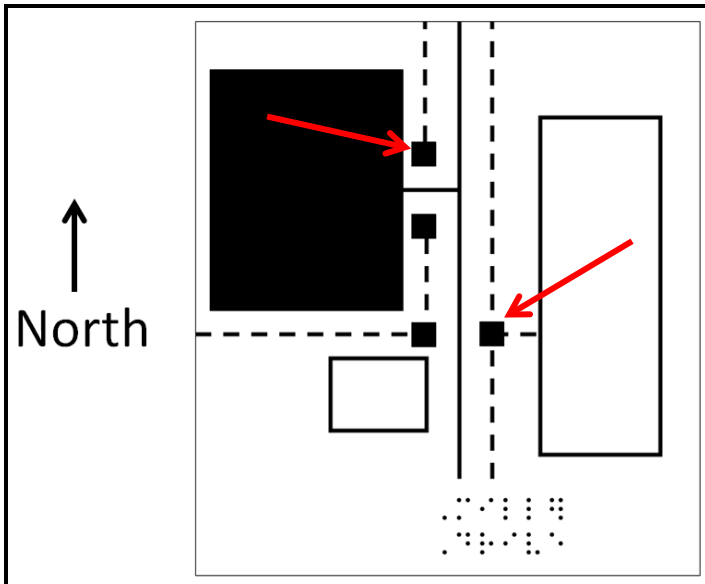


Figure 18: Print line drawing of a parking lot, sidewalk dash lines, two buildings, and one street. The street is identified in braille. Two red arrows indicate two ramps at sidewalk stop points.

## Embossing

### Hardcopy Production

For card stock production that will directly print (emboss) from Microsoft Word, a ViewPlus (Tiger) embosser is the only solution (for now).



Figure 19: Photograph of a ViewPlus Embosser Caption:

For a more inexpensive production and more durable (for outside lessons) solution, copying an outline tactile map on microcapsulate (swell) paper is a good option. The paper has a type of rubber-like surface consisting of microscopic (bubbles) that will swell up on the black line areas when heated by a machine called a Picture-In-A-Flash (PIAF) or Tactile Image Enhancer (TIE).



Figure 20: Photograph of a Tactile Image Enhancer

## References

- Braille Authority of North America (BANA) (2011). *Braille Formats Principles of Print-to-Braille Transcription, 2010*, [www.brailleauthority.org](http://www.brailleauthority.org).
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- Ishikawa, T., H.Gujiwara, O.Imai, and A. Okabe (2008). "Wayfindings with a GPS-based mobile navigation system: A comparison with maps and direct experience." Journal of Environmental Psychology 28: 74-82.
- Parush, A. S. Ahuria, and I. Erev. (2007). "Degradation in spatial knowledge acquisition when using automatic navigation systems." Lecture Notes in Computer Science, 4736: 228-54.

## Texas School for the Blind & Visually Impaired Outreach Programs



Figure 21 TSBVI logo.



This project is supported by the U.S. Department of Education, Special Education Program (OSEP). Opinions expressed here are the authors and do not necessarily represent the position of the Department of Education.

Figure 22 IDEAs that Work logo and OSEP disclaimer.