WAKA KOTAHI
NZ TRANSPORT AGENCY

ELECTRONIC MESSAGE SIGNAGE FONTS

Intelligent Transport Systems (ITS) Core Requirements Standard

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FINAL DRAFT

New Zealand Government

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More information about ITS is available on the Waka Kotahi website at https://www.nzta.govt.nz/its

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1 OVERVIEW AND OUTCOMES

This section defines the core requirements to support operational outcomes for ITS with respect to the transport network.

1.1 Purpose

The purpose of this core requirements standard is to provide requirements for fonts used on Variable message signs (VMS) – fixed and Lane and carriageway signs (LCS), respectively. The target application of this document is SM031 and SM032 – State highway construction and maintenance contract proforma manuals.

1.2 Overview

Legacy low resolution VMS constrained the ability to define fonts in isolation of the display matrix, and the ability to support multiple font sizes.

As VMS and LCS have coarse pixel spacing or predefined messages. This only allowed for a single set of fonts to be defined, which were based on a 5×7 character block size or were fixed in place at the time of manufacture.

With the move to higher resolution signage (signage with a smaller distance between pixels or smaller pixel pitch), the fonts are no longer constrained by the display matrix. This means that the older fonts based on legacy technologies are no longer suitable and a new font and visibility standard is required. This core requirements standard is suitable for application on VMS and LCS to define font dimensions.

1.2.1 NZTA ITS class

001 Signs. Electronic displays which provide visual messages to transport network users.
Class definitions

1.3 Scope

This core requirements standard covers font standards and dimensions for VMS and LCS (including uppercase letters, digits and special characters).

Fonts defined in this core requirements standard cover all types of VMS and LCS. The document also contains business rules used to generate both standard (200mm, 300mm and 400mm) or any non-standard fonts that may be required for specialist applications.

Legacy VMS are not covered by this core requirements standard.

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1.4 Outcomes

Electronic signs are one of the primary methods used by the Client to communicate to road users once they are travelling on the transport network. The key outcomes of this core requirements standard are to:

i. ensure that visibility requirements for the operating environment are defined to ensure legibility of messages
ii. define a set of standard fonts that can be applied to VMS and LCS, without being constrained by the device or technology
iii. define the set of business rules that can be applied to all electronic message signs used by road controlling authorities (RCAs) that are subject to the Land Transport Rule: Traffic Control Devices 2004 (TCD Rule). This does not include advertising signs.

1.4.1 Operational

The operational outcome of this core requirements standard is to:

i. support advanced messaging capabilities, such as:
   - uppercase fonts
   - special characters
   - digits
ii. ensure the operational requirements of RCAs and transport operations centres (TOCs) are met
iii. ensure any current, and future, operational requirements are met (eg dual language support).

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2 DESIGN FOR OPERATION

This section defines the core functionality required to support successful operation of the ITS.

2.1 Operational environment

The choice of electronic sign display is dictated by the location, intended operational application and message requirements.

The font is a function of VMS type selected according to the ITS design standard: Variable message signs – fixed. There is a close relationship between site selection and selection of the sign size/display technology.

Once these operational criteria are set, the requirements in this core requirements standard shall be applied.

2.2 Character height

Table 1. Electronic signage – minimum character height summarises the recommended minimum character height for motorway, expressway, high-volume urban (HVU) and rural environments for a range of speed environments, and single or dual-lane roadways. VMS and LCS listed in the table shall comply with the latest versions of ITS delivery specification: Variable message signs – fixed and ITS delivery specification: Lane and carriageway signs (LCS), respectively. The minimum character heights are derived from:

i. EN 12966:2015+A1:2019 *Road vertical signs – Variable message traffic signs*, table N.5 titled Examples for recognition time depending on character height, speed and vertical beam width
ii. the TCD Rule.

	HVU and rural – side mount with <6m offset (from left-hand side in the direction of travel)				**Motorway or expressway – overhead or side mount with <6m offset (from left-hand side in the direction of travel)**		
	Single lane in the direction of travel	**Double lane in the direction of travel**	**Double lane in the direction of travel**				
Speed environment	**Four-line regional type A or C VMS**	**Four-line regional type A or C VMS**	**Three-line urban type D VMS**	**LCS**	**Three-line motorway VMS**	**Four-line regional type A VMS**	**LCS**
Up to 50km/h	200 (type C)	200 (type C)	200	200	–	–	–
51–70km/h	200 (type C)	300	200	300	–	–	–
71–100km/h	300	300	–	300	400	300	400
110km/h	–	–	–	–	400	–	400

Table 1. Electronic signage – minimum character height in mm

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2.3 Display attributes

2.3.1 Display size

The choice of electronic sign display is dictated by the operational environment and conditions, and message requirements. Detailed information on VMS types and display sizes are described in:

i. the section titled Character height in the latest version of ITS design standard: Variable message signs – fixed
ii. the appendix titled NZTA VMS types in the latest version of ITS delivery specification: Variable message signs – fixed
iii. Table 1. Electronic signage – minimum character height in section 2.2 Character height of this core requirements standard.

Both vertical and horizontal spacing of pixels must be consistent across the entire display.

Full matrix signs are standard for all NZTA applications where flexibility to support text heights greater than the standard line height and/or graphics in the future is required.

2.3.2 Font colour options

The permitted colours for the font on electronic signage are yellow or white as per the TCD Rule.

Combination of colours is not allowed on the same display.

New variants of the Regional Type D VMS are the exception to this rule. The Destination portion of the message is always white, but the Journey Time portion can dynamically change from white to yellow or red depending on the deviation of current journey times from usual journey time for that day & time of day.

2.3.3 Font display business rules

Character, word and line spacing requirements provide a proportionally correct text appearance that allows the sign to be more easily read from a distance. Along with other parameters such as font height, they help the designer to determine sign size and therefore the requirements for space at the roadside/on a gantry for the sign. This is important for consistency across the range of electronic signs used on the New Zealand road network.

The business rules for developing an electronic font are as follows:

i. Character shape:
   - The shapes of fonts displayed on VMS and LCS shall be as near as practicable to Series D of AS 1744:2015 *Standard alphabets for road sign* (Series D of AS 1744) (with the exception of the narrow font for urban type D VMS).
   - The character stroke width will be as per width of the letter I for the corresponding font height, as shown in Figure 2. Example of typical features for dimensions of the character.
   - For characters with a single vertical stroke (ie I, J and T), only T must have a horizontal stroke at the top to avoid confusion between these characters.

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– Characters that have a diagonal stroke (ie A, X, Y and V) must use the diagonal stroke format rather than a vertical stroke to establish the character shape. Examples of correct and incorrect character format are shown in Figure 1. Comparison of permitted and non-permitted characters.

Correct character format **Incorrect character format**

Figure 1. Comparison of permitted and non-permitted characters

ii. Character, word and line spacing:

– A character slot is made up of the two spaces (margins): to the right of the first character and to the left of the next character. A margin is the number of unilluminated pixel columns to the left or to the right of a character. The left and right margins are specific to each character. Standard fonts (200mm, 300mm and 400mm) shall comply with font maps explaining the character dimensions and margin spacing as defined in Appendix A: font maps for standard VMS and LCS fonts of this core requirements standard. Character dimensions and spacing for special non-standard fonts shall be developed using information from the table titled Standard alphabets spacing chart in Series D of AS 1744. Character slots for Q and comma (,) are 1 pixel higher and they both have an extra pixel below the baseline of all other characters.
– When a character message is composed, a character slot representing a character and both margins is set next to the following character slot. See relevant sections of Appendix A: font maps for standard VMS and LCS fonts in this core requirements standard. For horizontal spacing between words, a blank character for a corresponding font shall be used. The blank character has associated zero-margin spacing.
– Line spacing shall follow the guidelines defined in Appendix A: font maps for standard VMS and LCS fonts in this core requirements standard.
– Lines of text shall be middle aligned horizontally and vertically.

2.3.4 VMS and LCS controller requirements for font display

VMS and LCS controllers (as applicable) shall be capable of generating the display fonts and text layout as detailed in Table 2. Font and text format display parameters.

Attribute	VMS parameter	LCS parameter
Font	As near as practicable to uppercase font as defined in Series D of AS 1744. Font maps of standard fonts (200mm, 300mm and 400mm) are shown in	It is only applicable to digits. As near as practicable as defined in Series D of AS 1744. Font maps of standard fonts (200mm, 300mm and 400mm) are shown in

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Attribute	VMS parameter	LCS parameter
	Appendix A: font maps for standard VMS and LCS fonts	Appendix A: font maps for standard VMS and LCS fonts
Character height	See Table 1. Electronic signage – minimum character height, in this core requirements standard. Application depends on operational environment.	It is only applicable to digits. See Table 1. Electronic signage – minimum character height, in this core requirements standard. Application depends on operational environment.
Character width	See Appendix A: font maps for standard VMS and LCS fonts.	It is only applicable to digits. See Appendix A: font maps for standard VMS and LCS fonts.
Character spacing – horizontal	See Appendix A: font maps for standard VMS and LCS fonts. Must be equal to or exceed a stroke width.	It is only applicable to digits. See Appendix A: font maps for standard VMS and LCS fonts.
Word spacing – horizontal	One blank character – consistent for the same electronic sign (this is a dimensionless number derived from the font height). For the dimensions of a blank character in the standard font, see Appendix A: font maps for standard VMS and LCS fonts. For a non-standard font, see the table titled Standard alphabets spacing chart in Series D of AS 1744.	Not applicable.
Line spacing	For the standard font, see corresponding information in Appendix A: font maps for standard VMS and LCS fonts For a non-standard font, it shall be between 0.4 to 0.6 of the character height	Not applicable.

Table 2. Font and text format display parameters

The VMS shall also be able to generate any combination of text and numerals, including standard punctuation and arrow display.

2.3.5 Default font formatting requirements

Default font settings shall be set and configured by the VMS as defined in this standard.

The expectation is that all requesting or setting entities (back-end systems and local controllers) will adhere to default font settings. This is to ensure that message formatting is consistent to all users regardless of who is setting the message.

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3 DESIGN FOR SAFETY

This section defines the core requirements to ensure the ITS can be operated and serviced safely.

3.1 Health and safety

All ITS equipment must be designed to ensure installation and maintenance in accordance with the Health and Safety at Work Act 2015.

3.2 Safety conditions and obligations

Messages which are displayed on VMS and LCS present a mechanism to communicate with road network users. Therefore, messages must be visible and legible under all conditions – users shall be able to easily read and comprehend messages on electronic signs in order to be able to react appropriately and in a timely manner. In order to meet these requirements for road users the following rules shall be followed:

i. VMS and LCS must meet visibility requirements.
ii. All fonts must meet the visibility requirements of this standard, including font sizes and rules for composing words and messages.
iii. All electronic signs installed on New Zealand roads shall comply with TCD Rule section 3.1(c). Electronic messages set on those signs shall convey a clear and consistent message to road users.

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4 DESIGN FOR MAINTAINABILITY

This section defines the core requirements to ensure the ITS can be maintained.

4.1 Maintenance conditions and obligations

Not applicable.

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5 DESIGN FOR SECURITY

This section defines the core requirements to ensure the ITS can be secured and maintain integrity.

5.1 Security conditions and obligations

Not applicable.

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6 APPENDIX A: FONT MAPS FOR STANDARD VMS AND LCS FONTS

This section contains Client font maps for standard fonts. A font map shows a visual representation of a character on an electronic sign using a sequence of illuminated pixels. Font maps include character dimensional and margin (required left and right spacing) information for VMS and LCS which comply with the latest versions of ITS delivery specification: Variable message signs – fixed and ITS delivery specification: Lane and carriageway signs (LCS), respectively.

Figure 3. Motorway and expressway VMS 400mm standard font maps, Figure 4. Regional type A VMS 300mm standard font maps, and Figure 5. Regional type C VMS 200mm standard font maps contain the closest approximation of character dimensions (in mm) provided in table 3: Standard alphabets spacing chart in Series D of AS 1744. The dimensions were developed by converting mm into pixels proportionally to the corresponding pixel pitch of three standard VMS signs. Figure 6. Urban type D VMS 200mm font maps does not follow Series D of AS 1744 requirements.

The character and stroke width and left and right margins (dark grey area on both sides of the character) can be obtained from font maps as shown in Figure 2. Example of typical features for dimensions of the character.

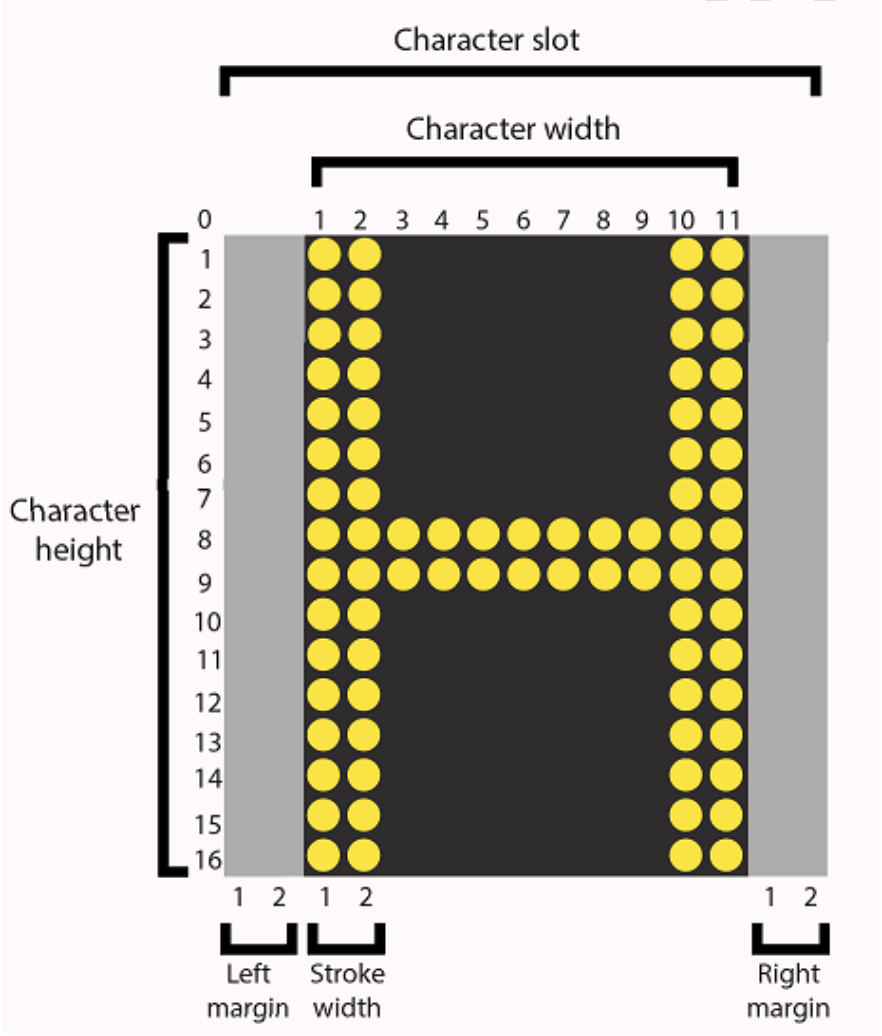

Figure 2. Example of typical features for dimensions of the character

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6.1 Motorway and expressway VMS – font maps

Motorway and expressway VMS (according to the latest version of ITS delivery specification: Variable message signs – fixed) have:

i. minimum of 352 pixels horizontally by 88 pixels vertically
ii. three lines of text
iii. maximum pixel pitch of 20mm
iv. minimum character height of 400mm or 21 pixels.

Line spacing for a 400mm-high font on motorway and expressway VMS is as follows:

i. Above a line of text: 3 rows of unilluminated pixels.
ii. Below a line of text: 5 rows of unilluminated pixels.
iii. The last row of pixels at the bottom of the VMS display matrix shall be blank.

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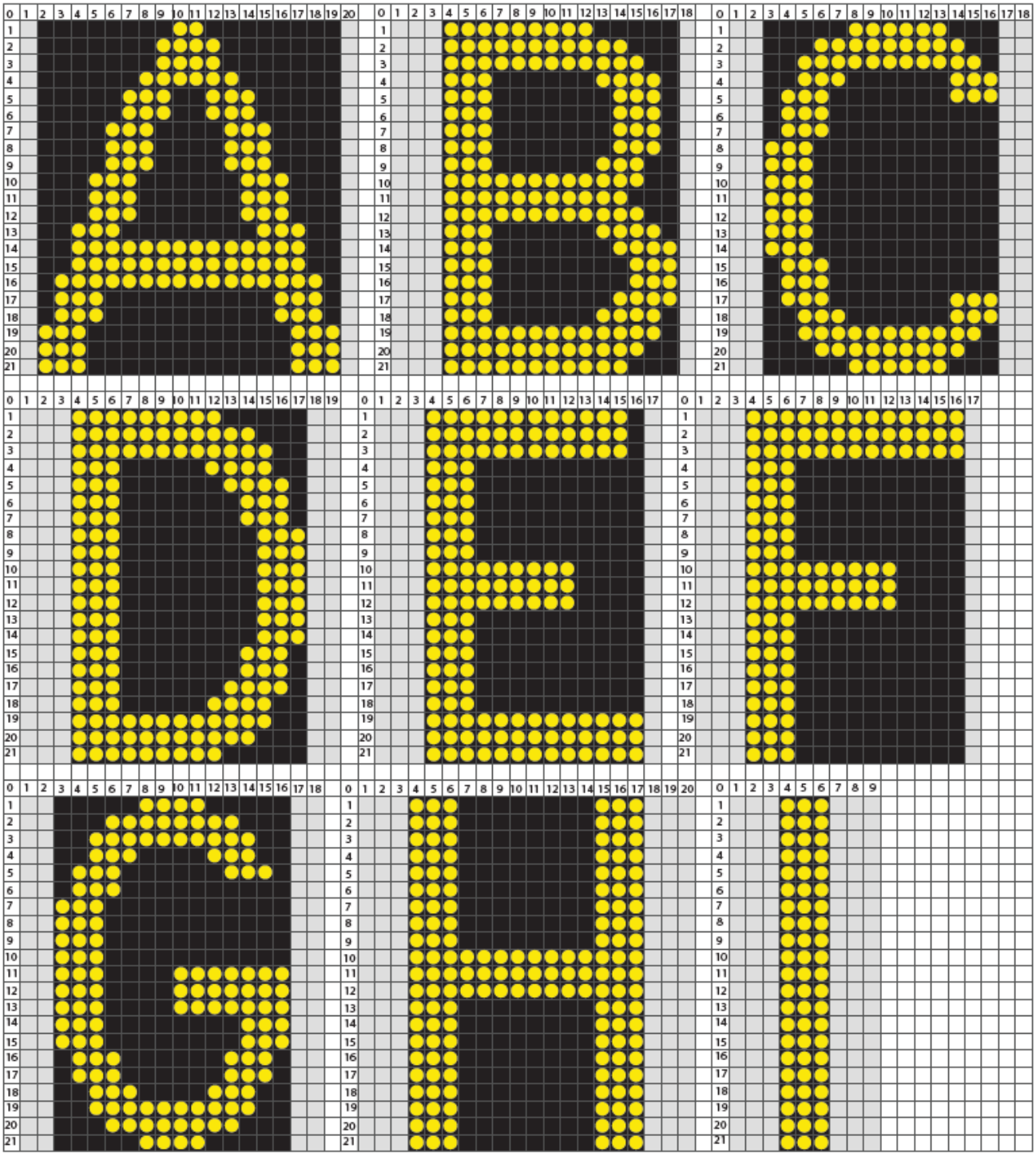

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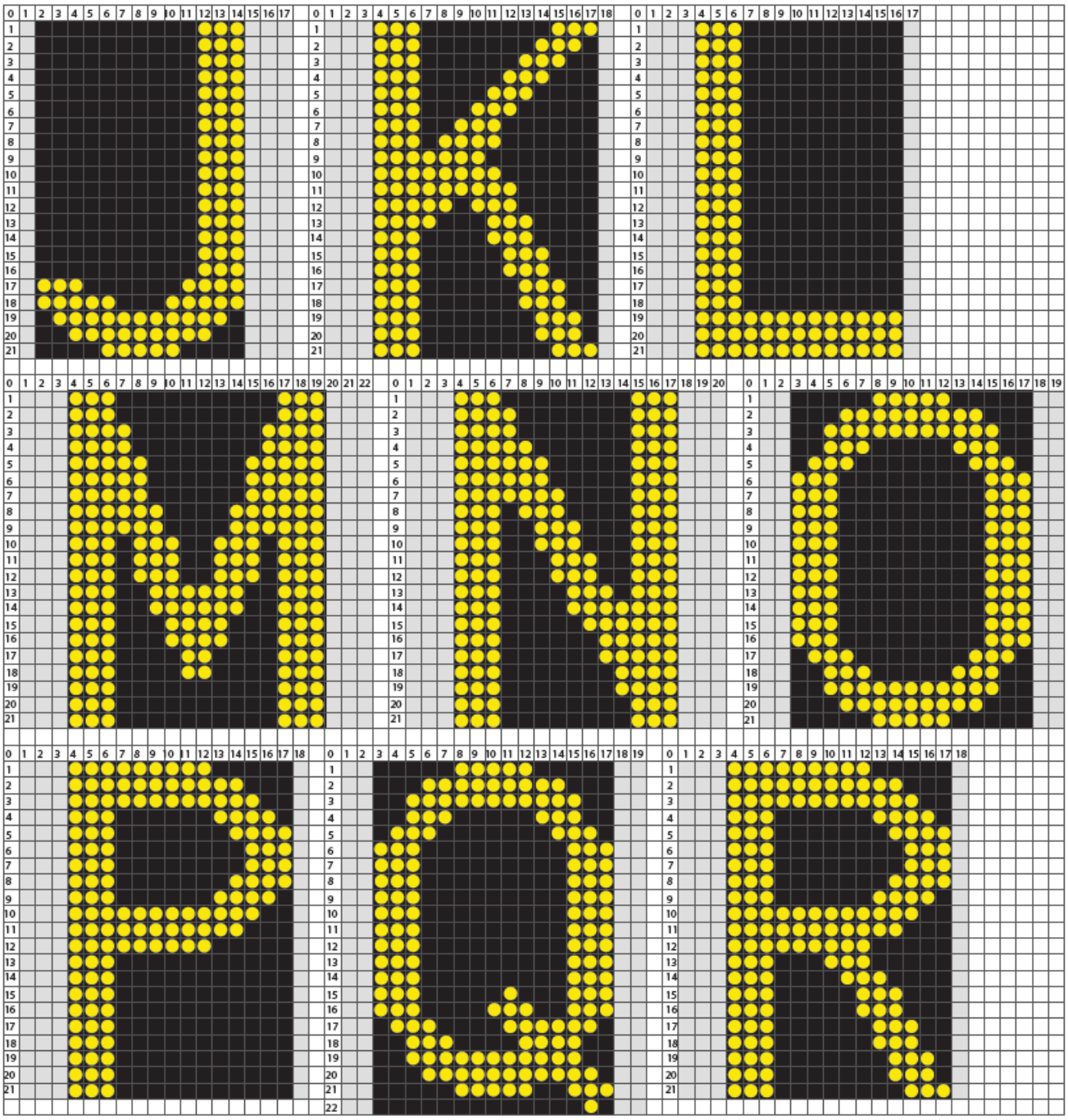

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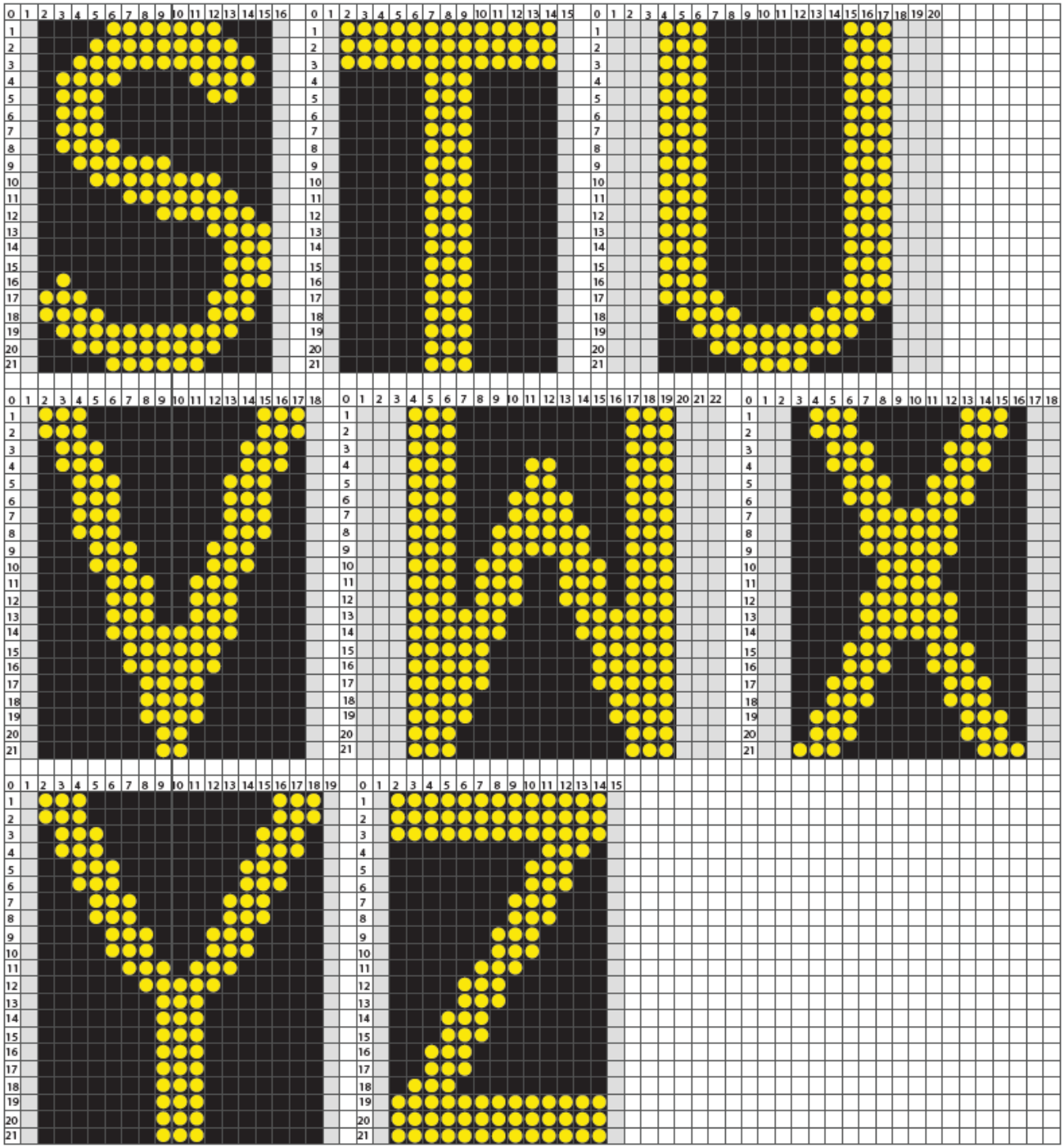

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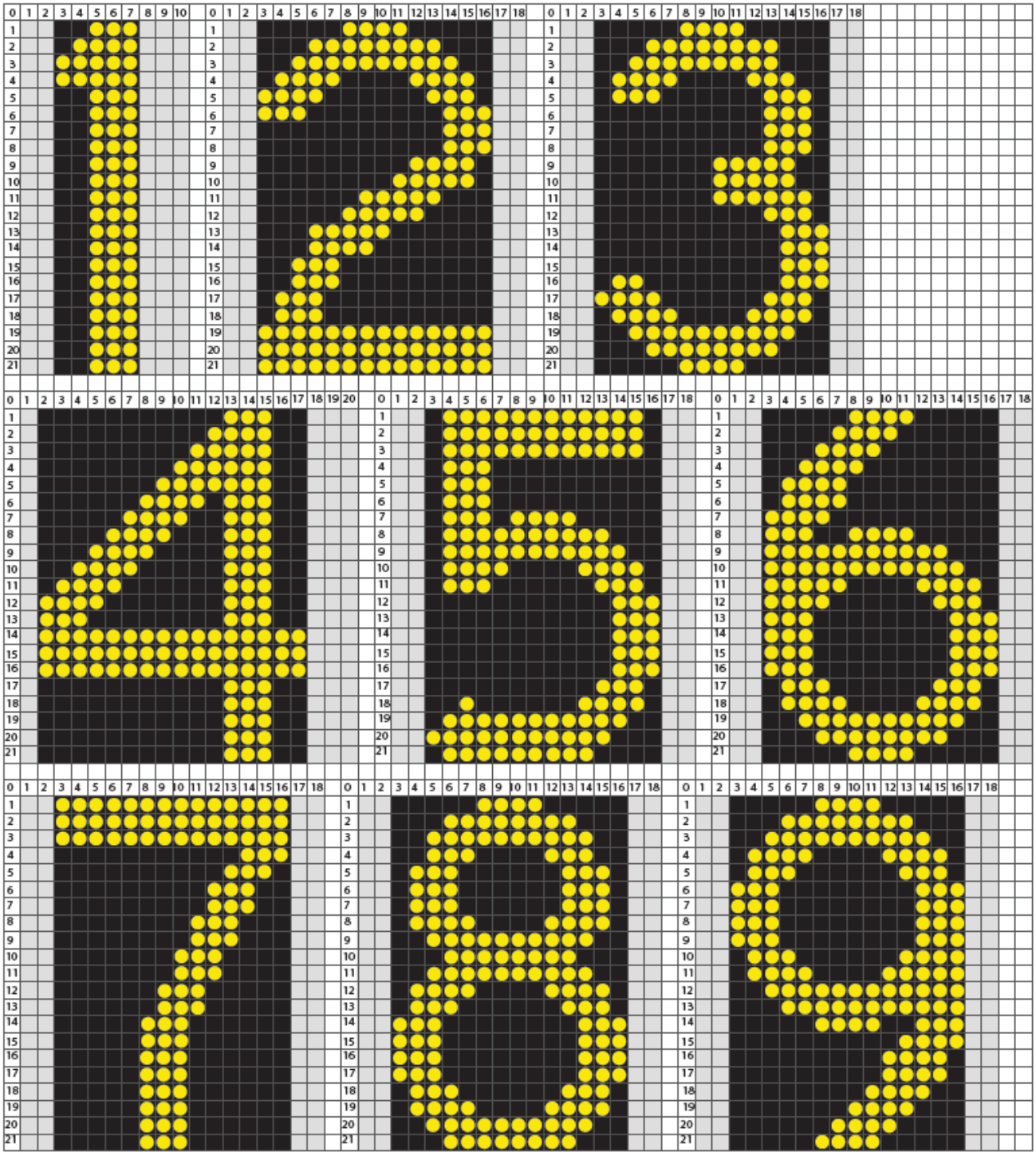

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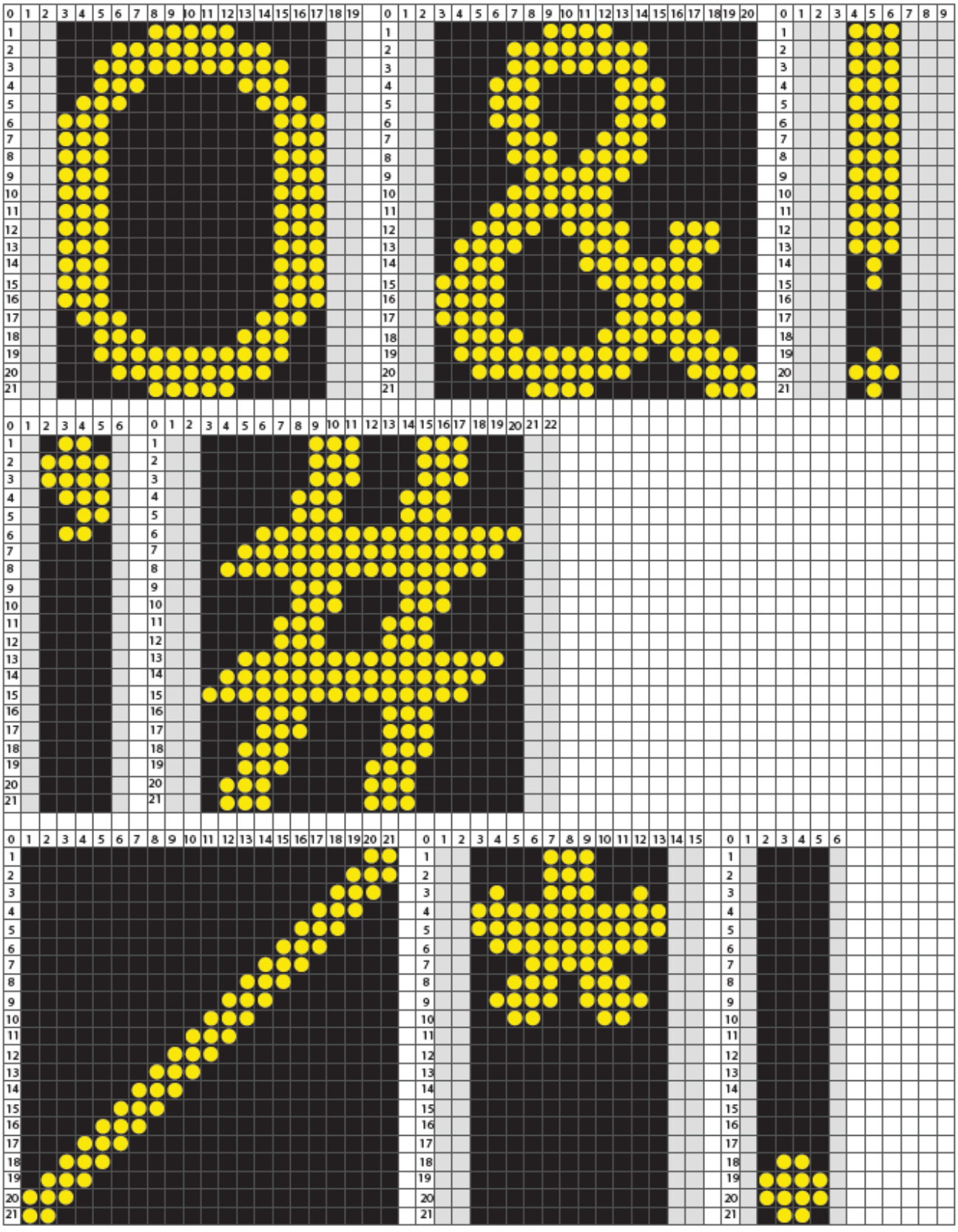

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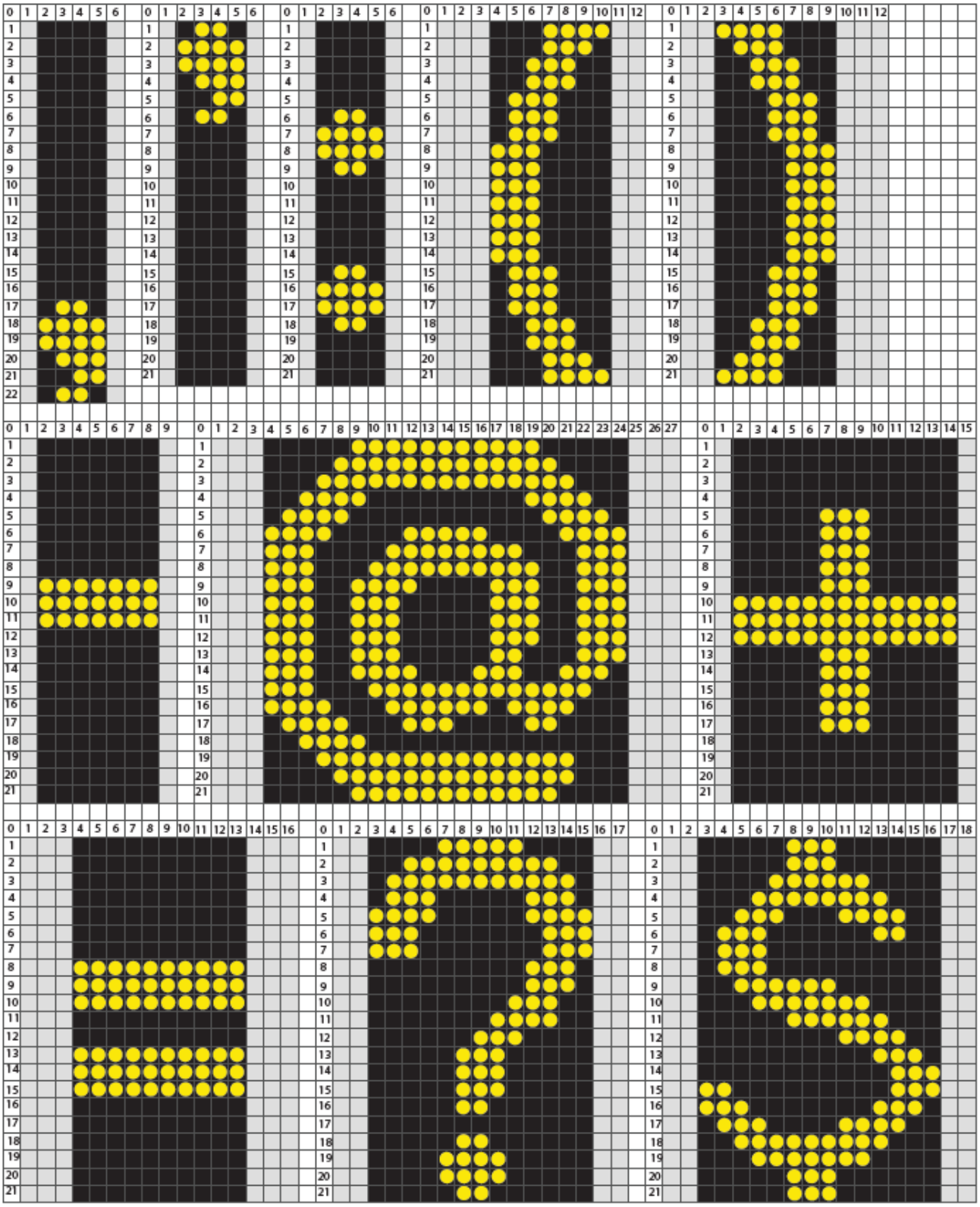

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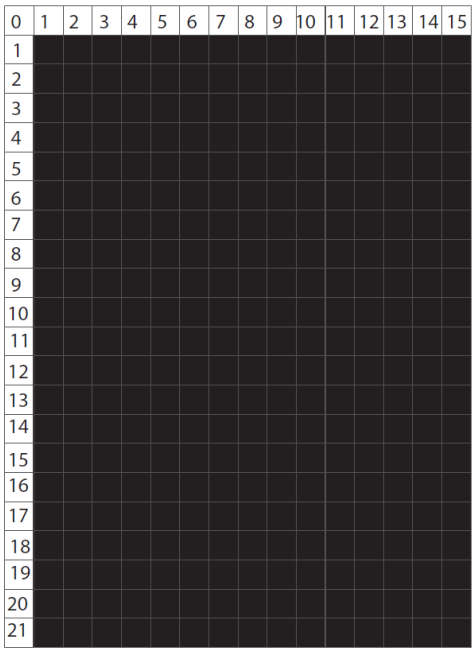

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Figure 3. Motorway and expressway VMS 400mm standard font maps

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6.2 Regional type A VMS font maps

Regional type A VMS (according to the latest version of ITS delivery specification: Variable message signs – fixed) have:

i. minimum 240 pixels horizontally by 104 pixels vertically
ii. four lines of text
iii. maximum pixel pitch of 20mm
iv. minimum character height of 300mm or 16 pixels.

Line spacing for a 300mm-high font on regional type A VMS is as follows:

i. Above a line of text: 3 rows of unilluminated pixels.
ii. Below a line of text: 5 rows of unilluminated pixels.

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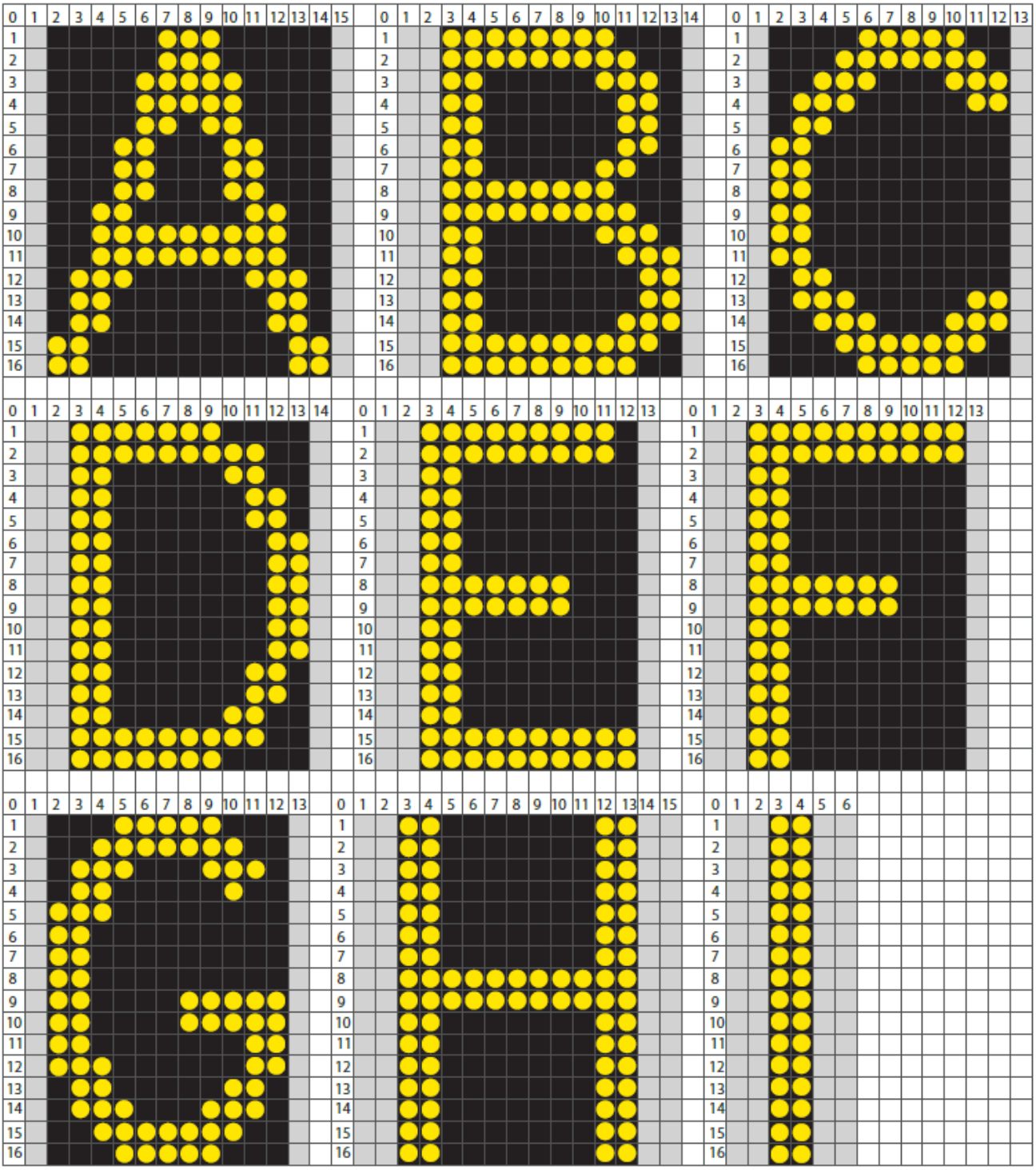

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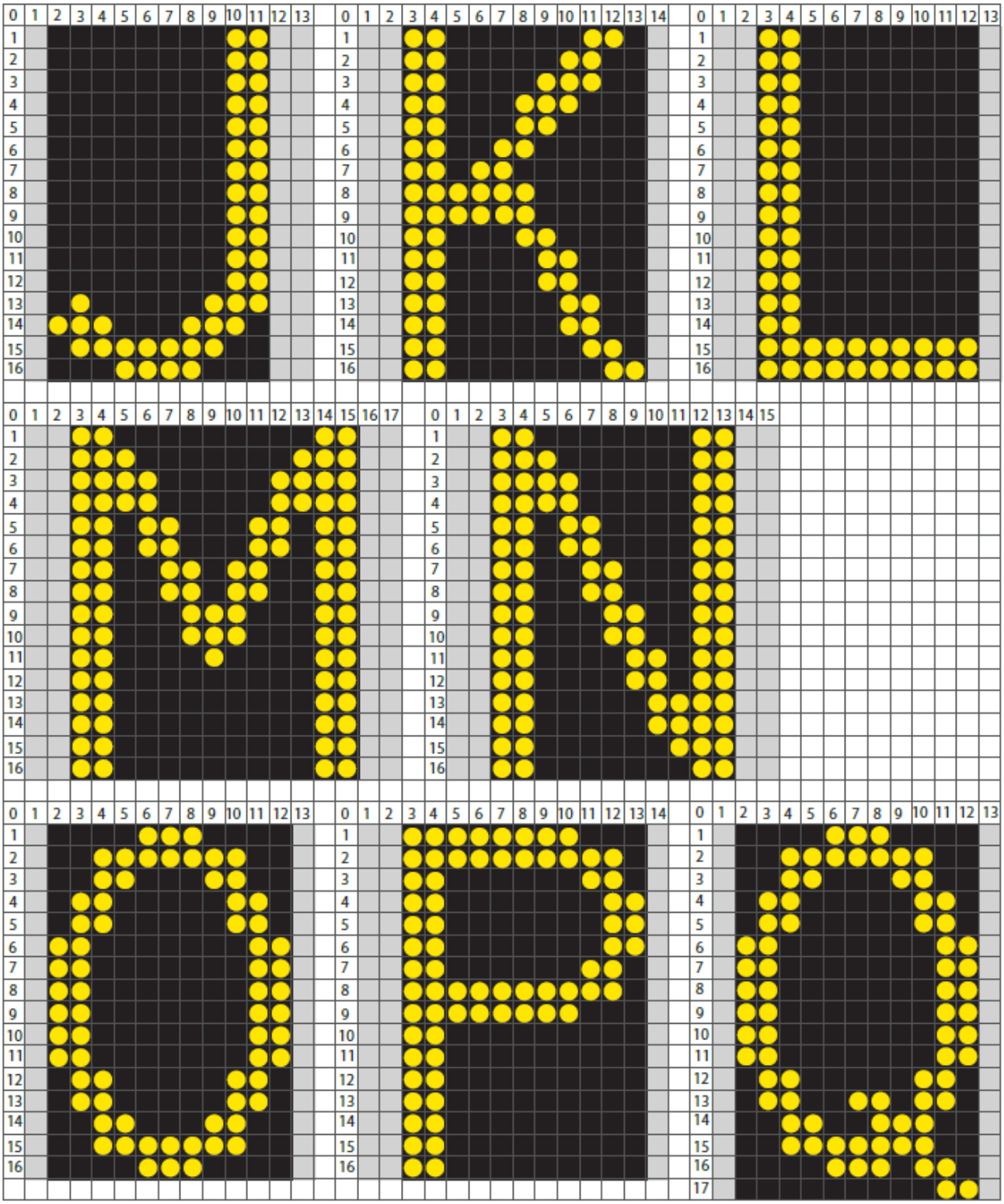

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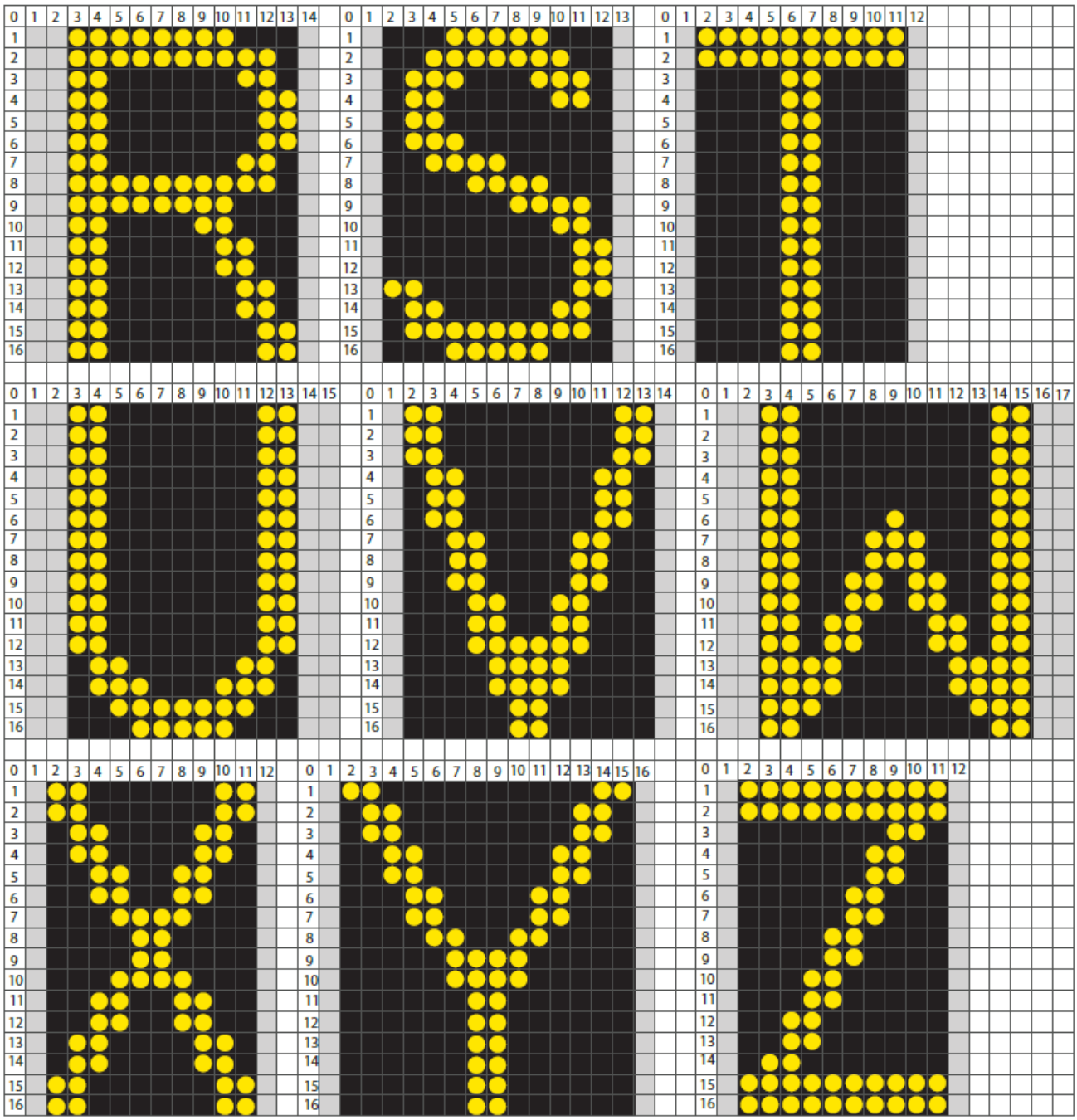

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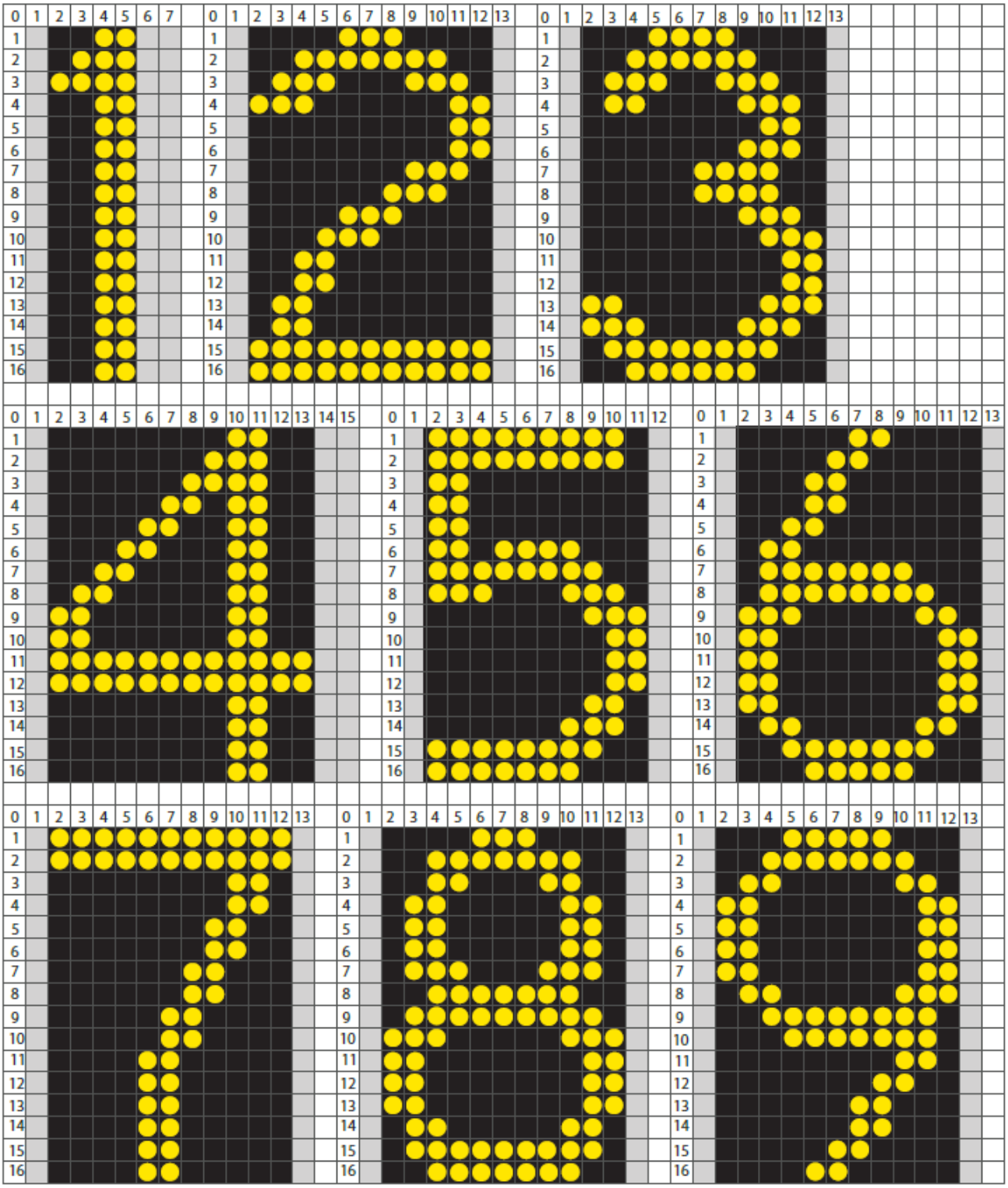

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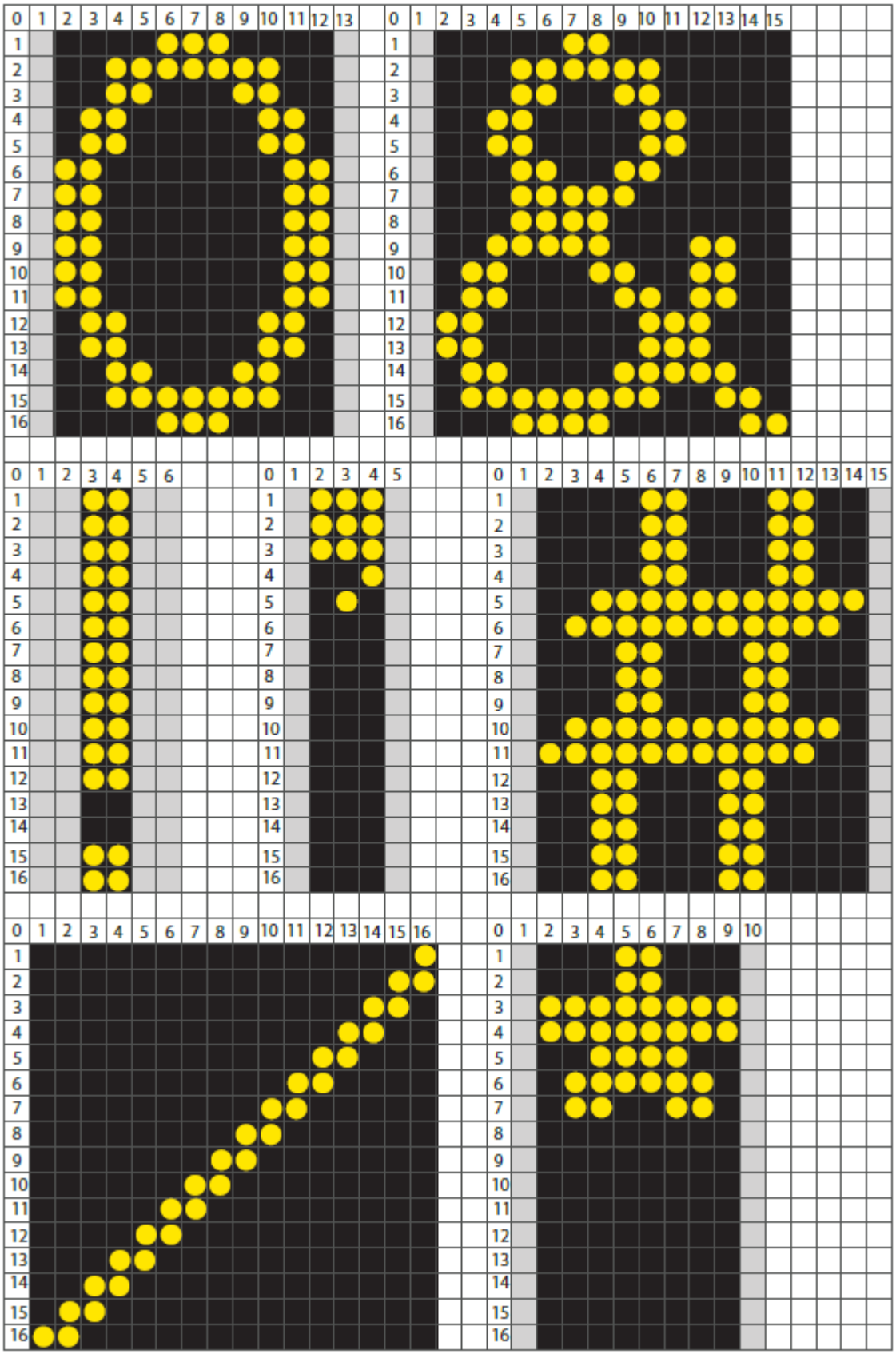

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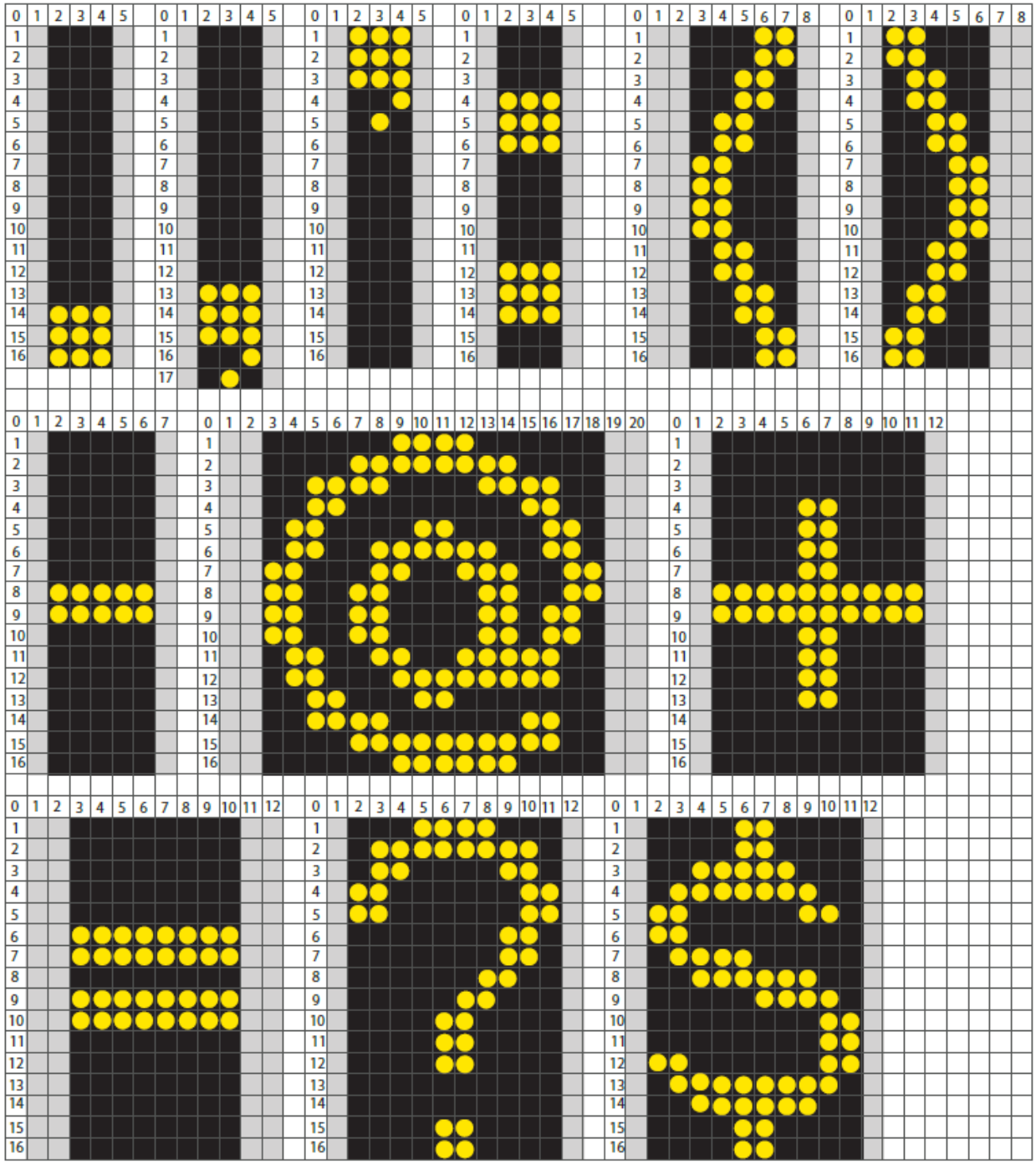

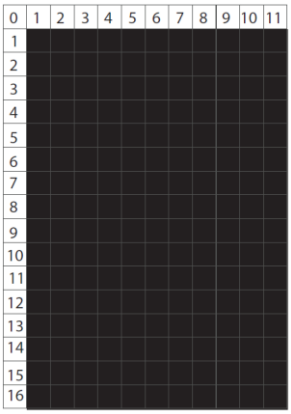

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Figure 4. Regional type A VMS 300mm standard font maps

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6.3 Regional type C VMS font maps

Regional type C VMS (according to the latest version of ITS delivery specification: Variable message signs – fixed) have:

i. minimum 192 pixels horizontally by 80 pixels vertically
ii. four lines of text
iii. maximum pixel pitch of 16mm
iv. minimum character height of 200mm or 13 pixels.

Line spacing for a 200mm-high font on regional type C VMS is as follows:

i. Above a line of text: 3 rows of unilluminated pixels.
ii. Below a line of text: 4 rows of unilluminated pixels.

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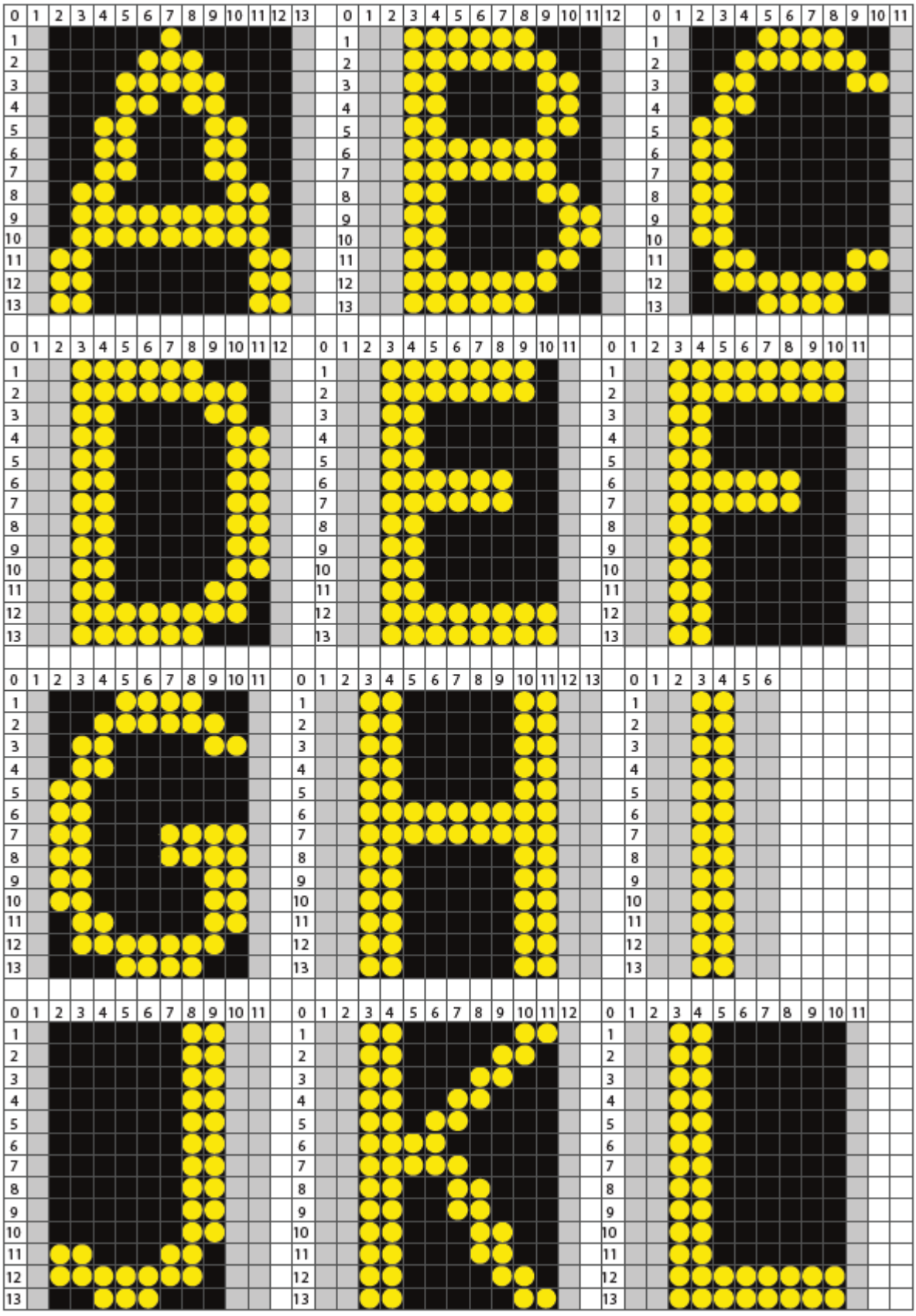

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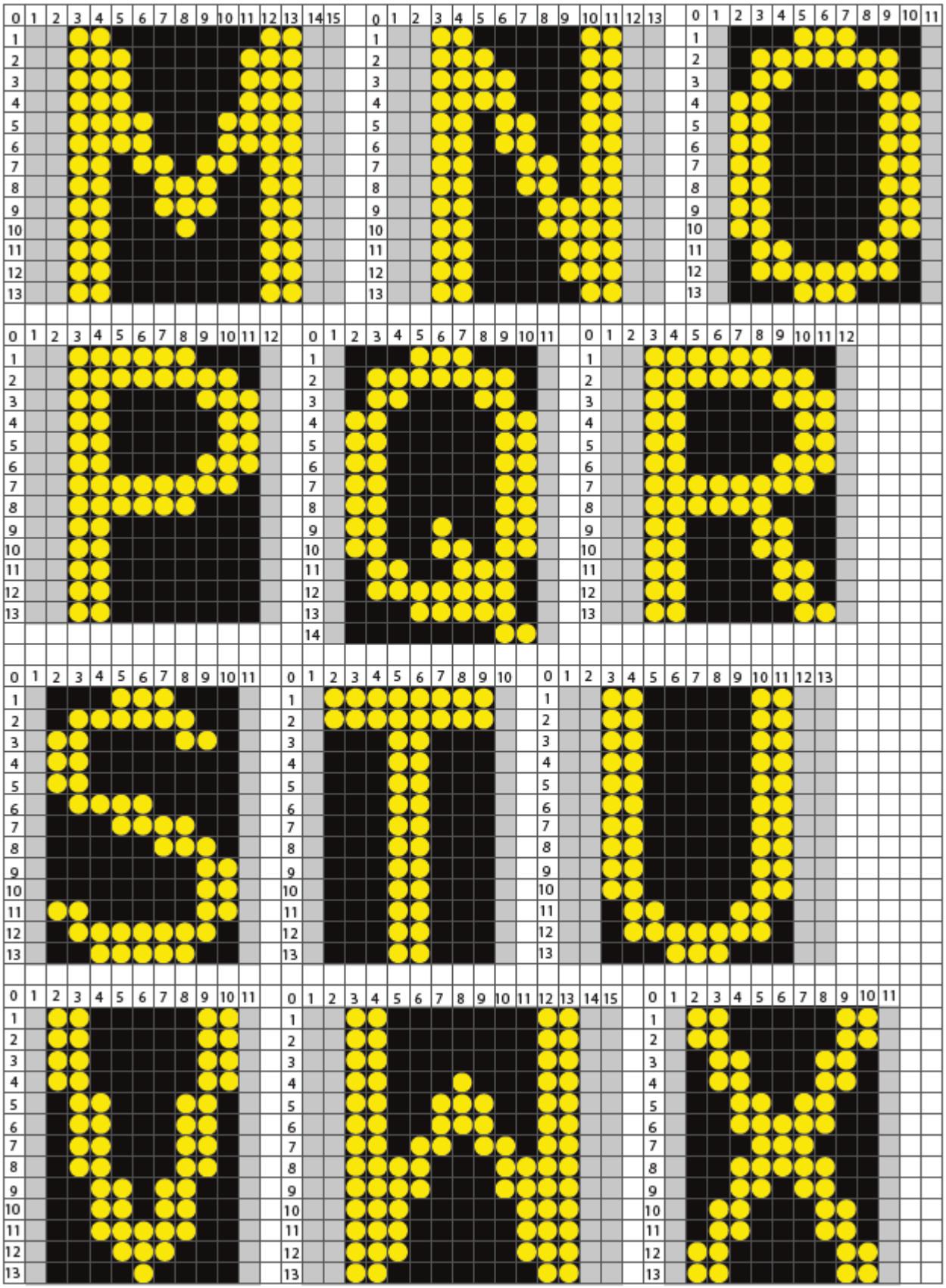

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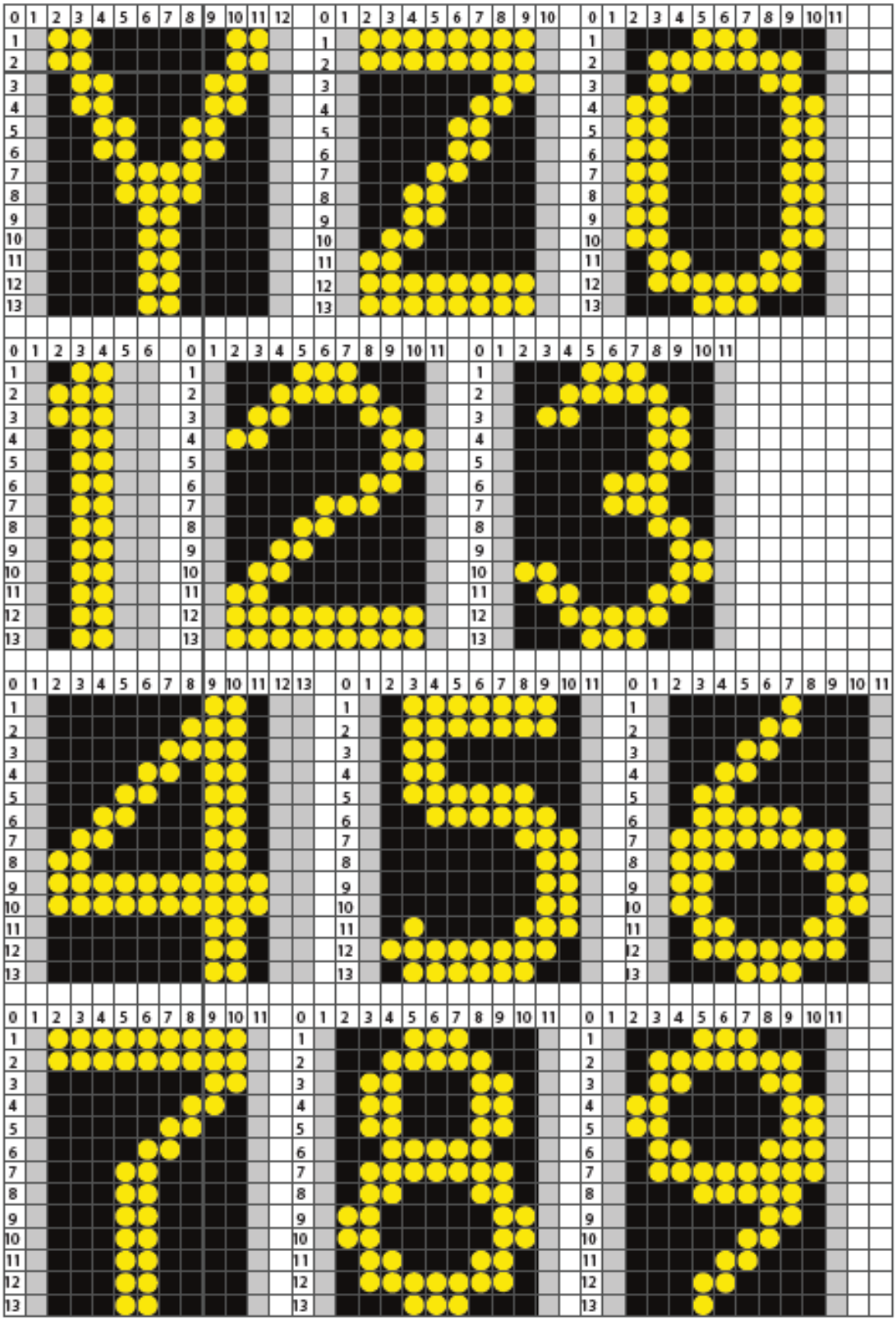

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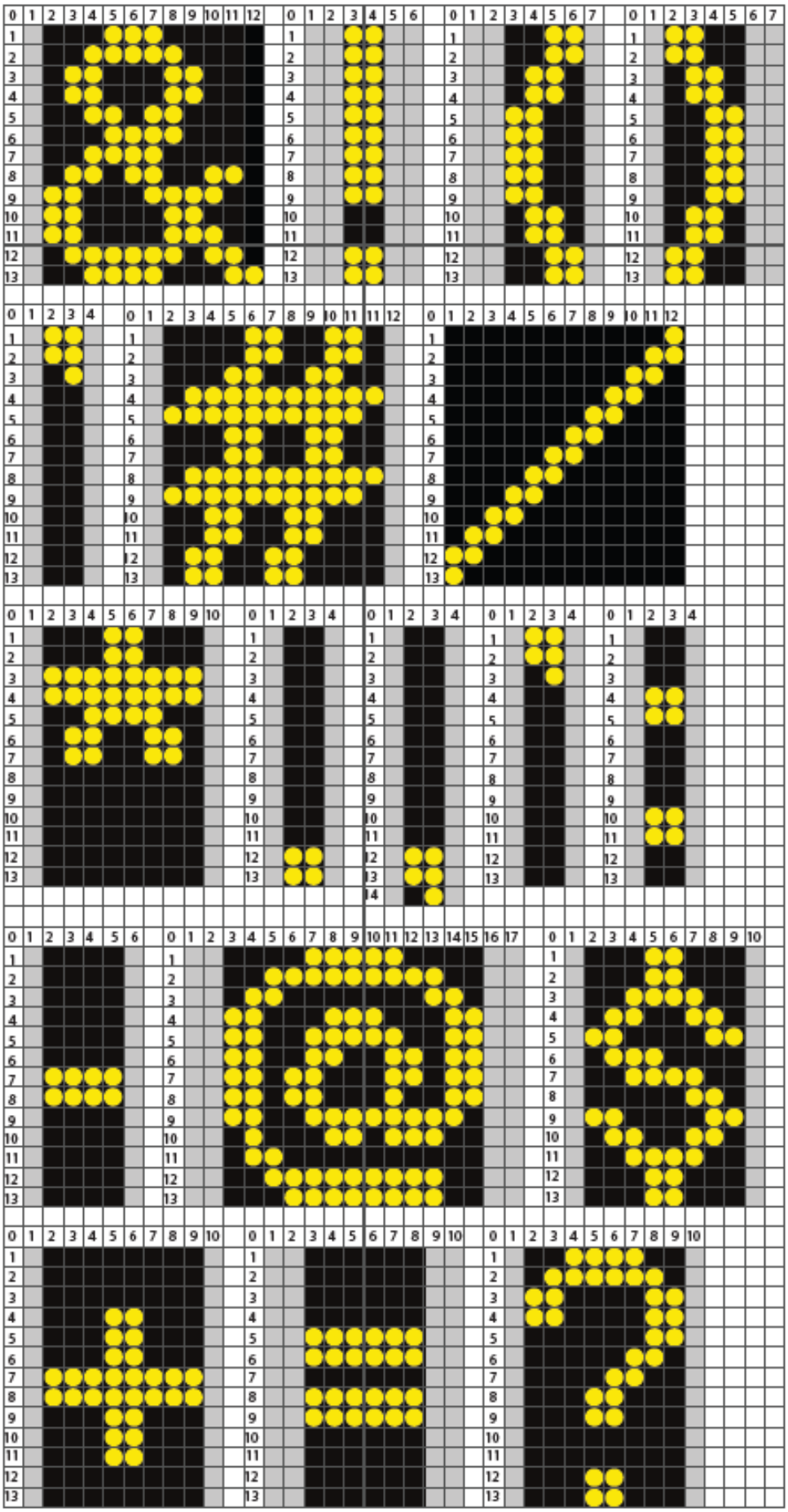

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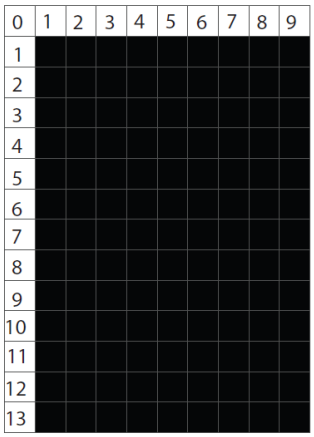

BLANK character

Figure 5. Regional type C VMS 200mm standard font maps

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6.4 Urban type D VMS font maps

Urban type D VMS (according to the latest version of ITS delivery specification: Variable message signs – fixed) have:

i. minimum 96 pixels horizontally by 56 pixels vertically
ii. three lines of text
iii. maximum pixel pitch of 16mm
iv. minimum character height of 200mm or 13 pixels.

Line spacing for a 200mm-high font on urban type D VMS is derived in MULTI (MarkUp Language for Transportation Information) by setting Page Justification tag [jp] to ‘center’ and NTCIPConfig LineSpacing parameter to 3 using 16-pixel high characters shown in the font maps below.

This has the effect of displaying:

i. Above the first line of text: 2 rows of unilluminated pixels
ii. Above the second line of text: 6 rows of unilluminated pixels.
iii. Above the third line of text: 6 rows of unilluminated pixels.
iv. Below the third line of text: 3 rows of unilluminated pixels.

For the incident management font maps detailed below the NTCIPConfig ‘CharSpacing’ parameter is set to 2.

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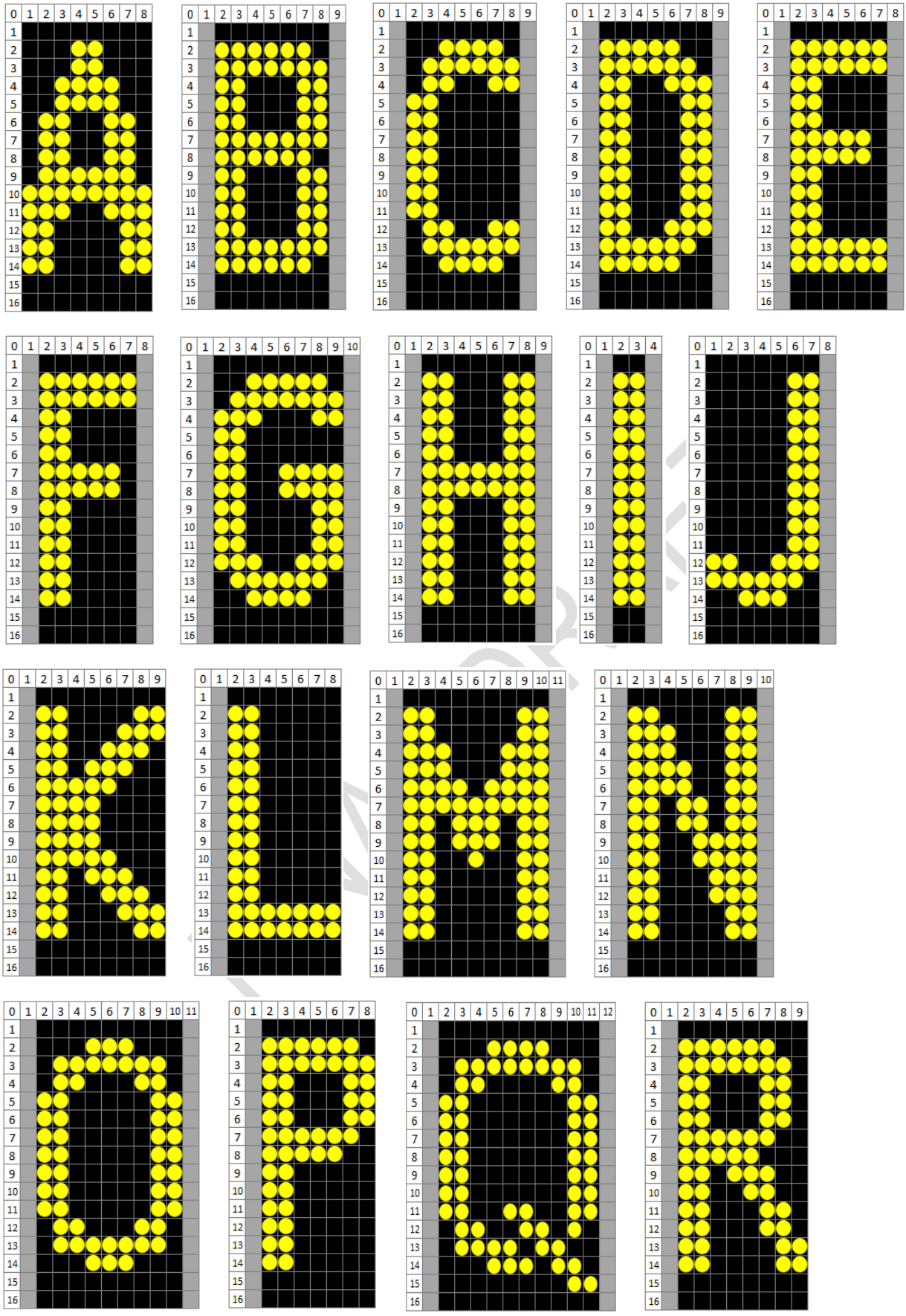

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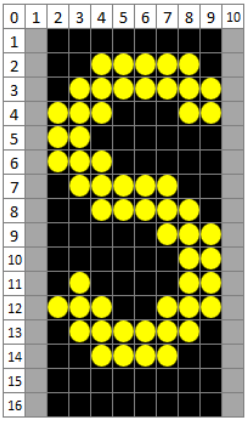

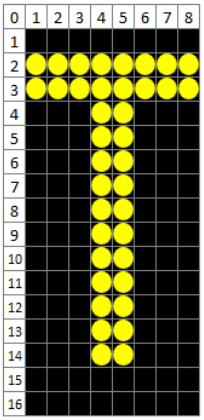

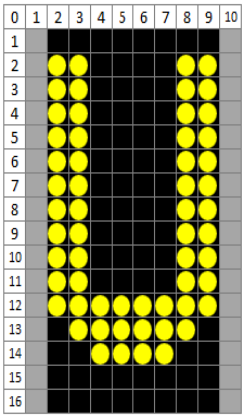

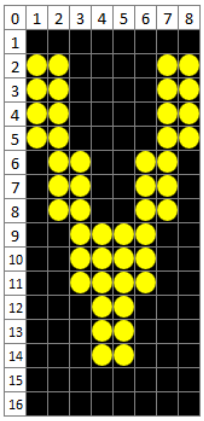

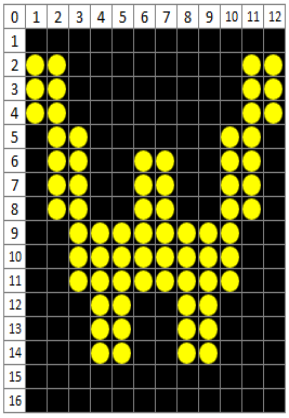

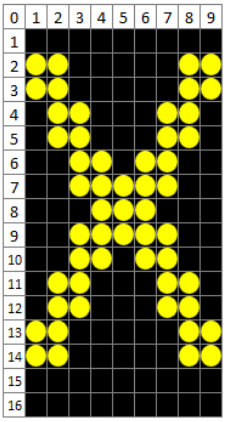

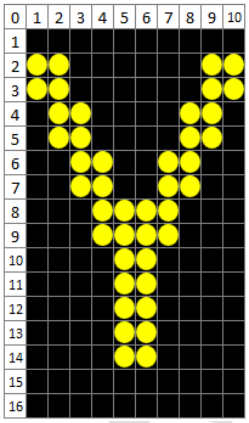

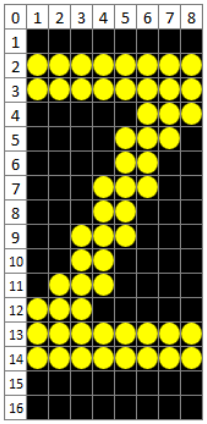

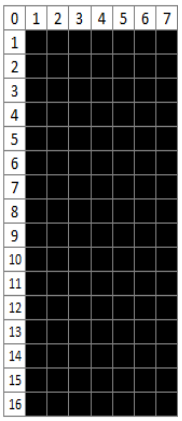

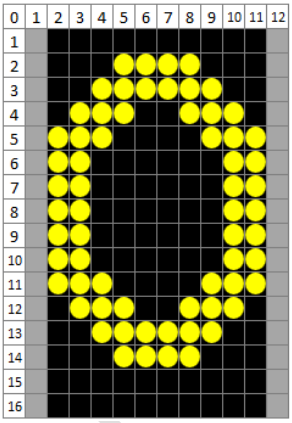

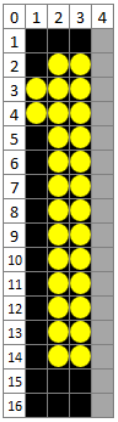

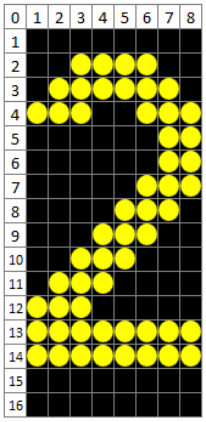

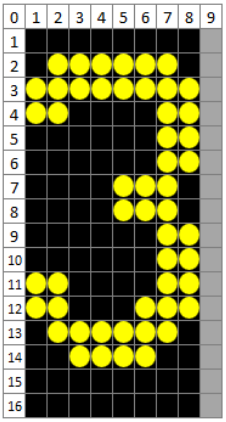

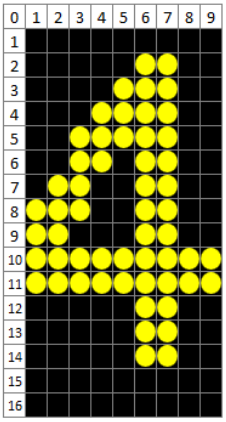

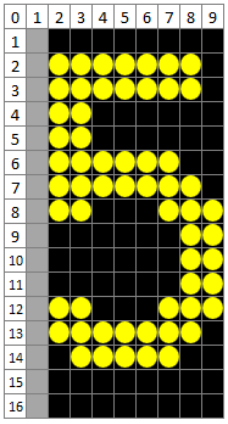

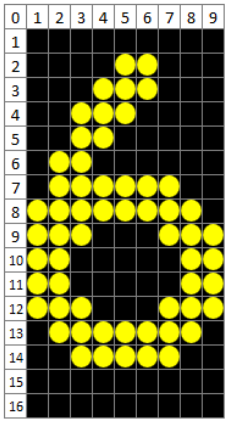

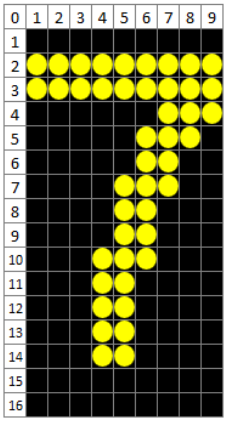

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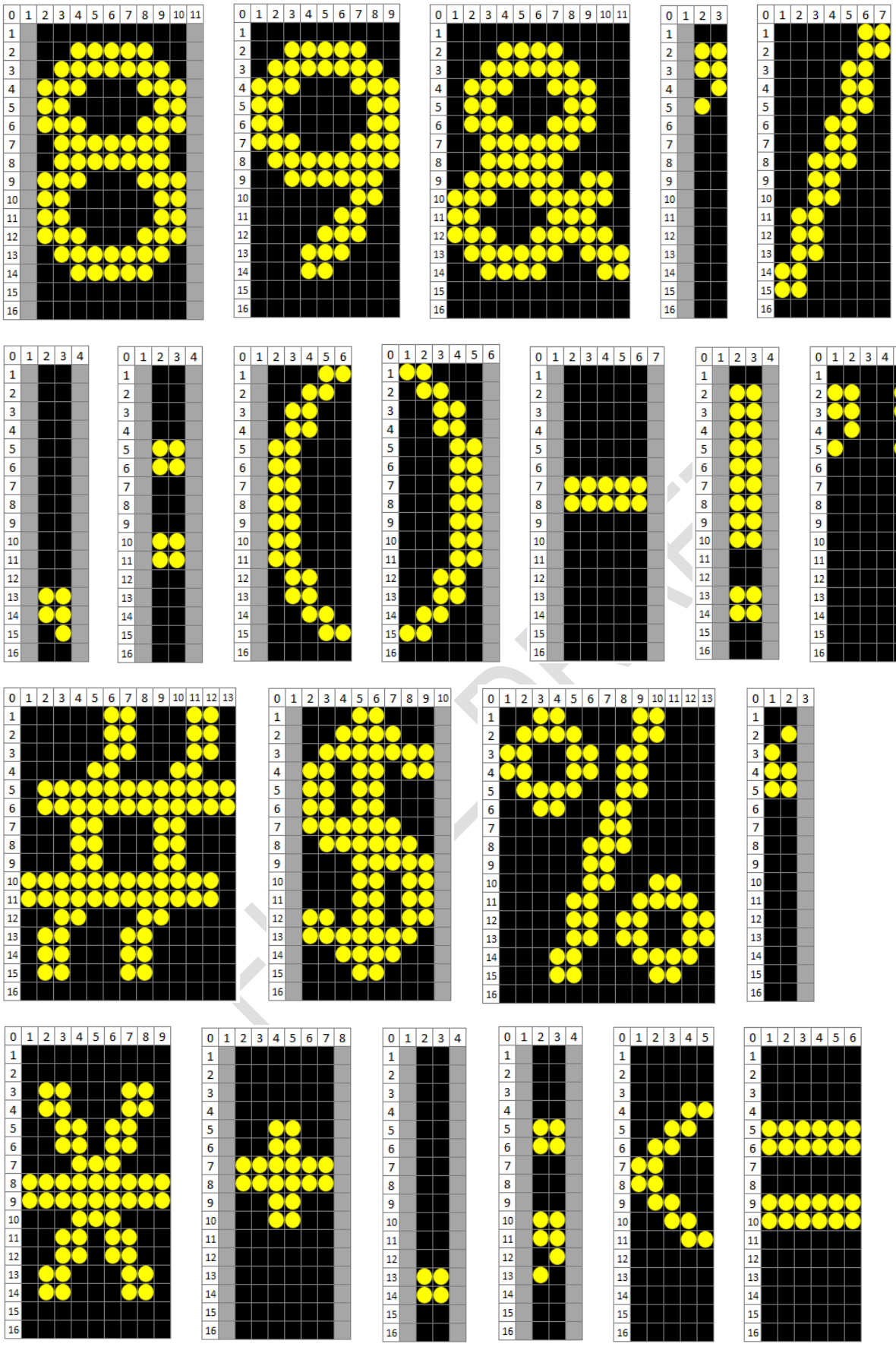

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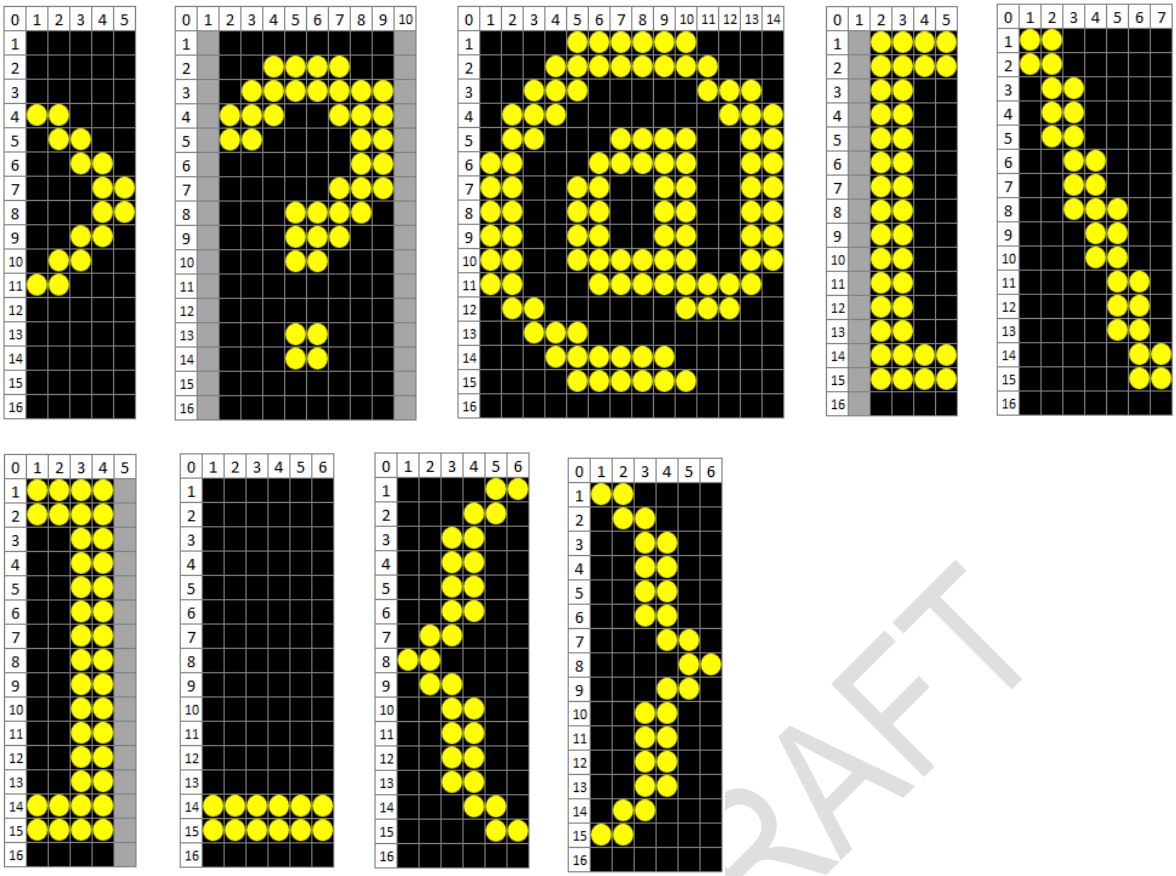

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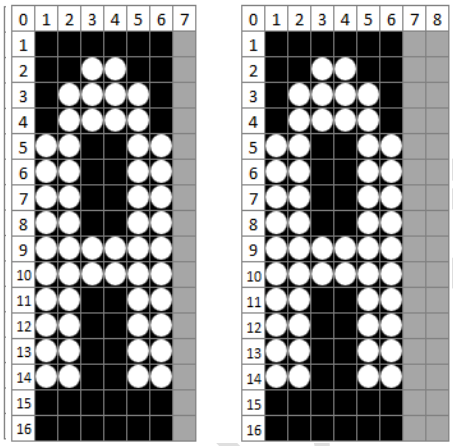
The condensed (Estimated Journey Time) font maps for the Regional Type D are designed to satisfy the need to display composite Destination / Journey Time information legibly within the relatively small amount of screen 'real estate' available. This relies on using left and right alignment with judicious use of non-illuminated pixels between characters.

For the estimated journey time font maps detailed below the NTCIPConfig 'CharSpacing' parameter is set to 0.

There are two font maps for **Destinations** which differ only in the width of the margin on the right side of the illuminated character; the 'core' illuminated pixel map of each character is identical with only the number of pixels in the non-illuminated margin differing e.g.:



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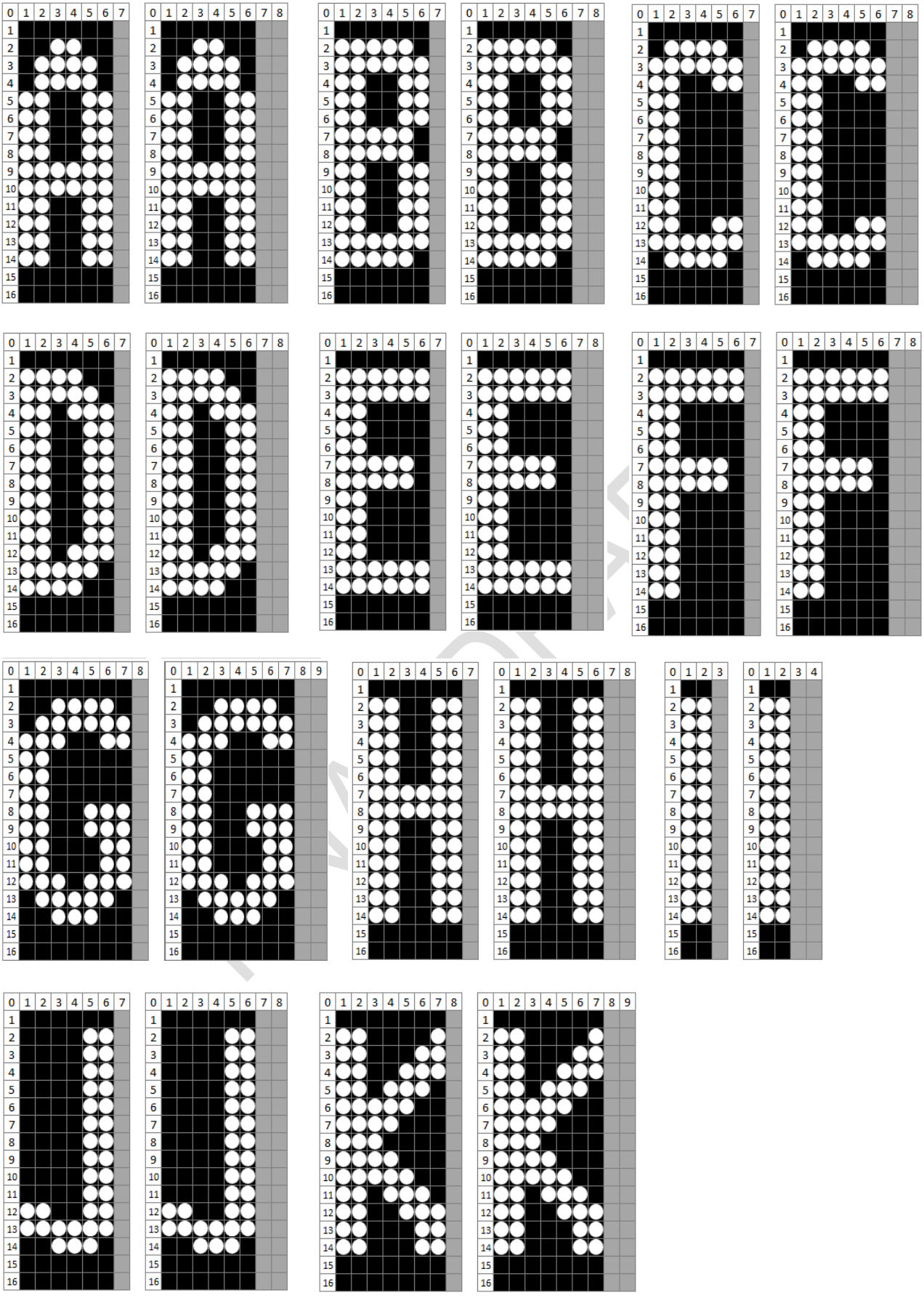

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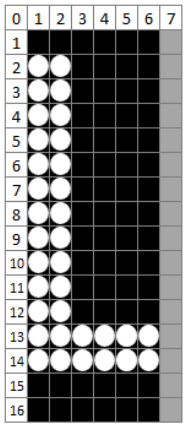

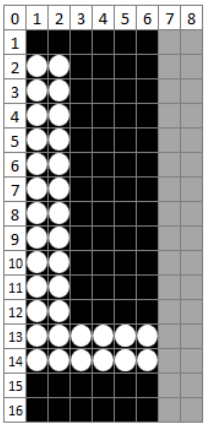

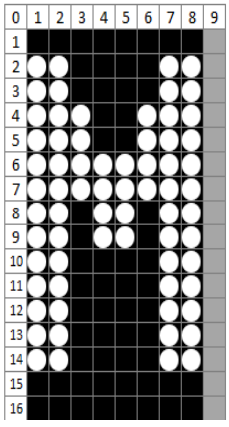

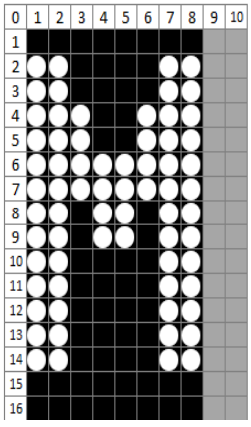

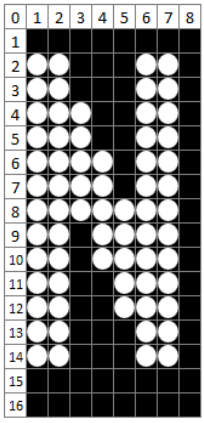

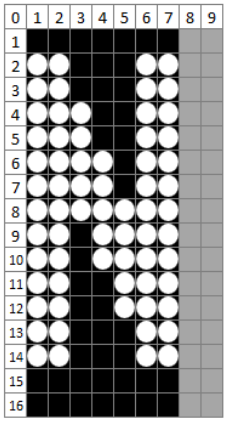

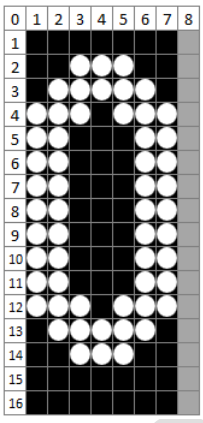

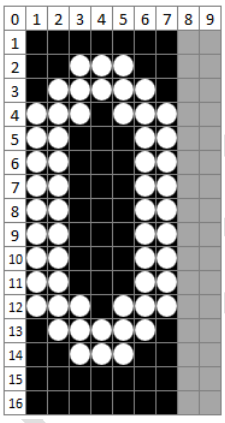

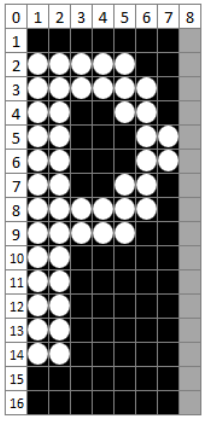

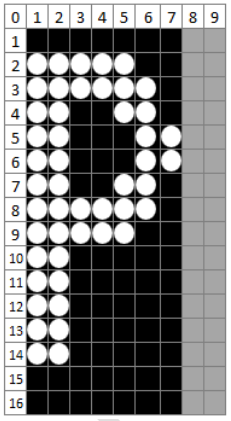

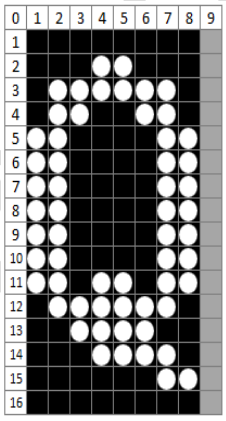

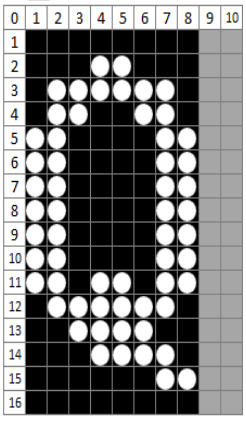

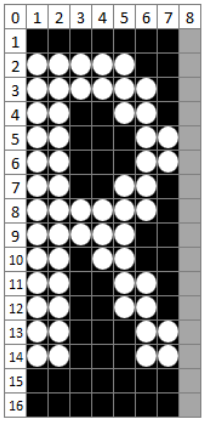

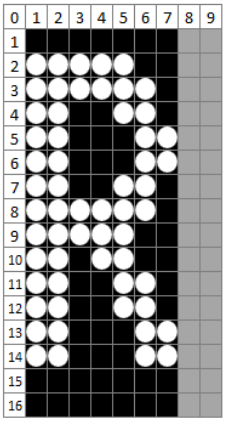

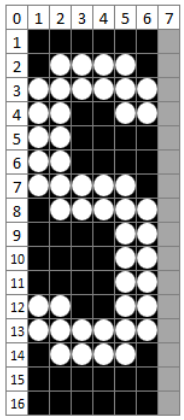

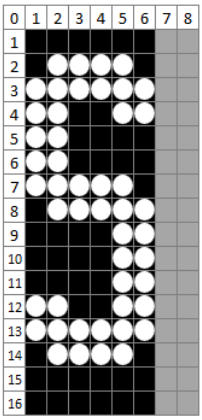

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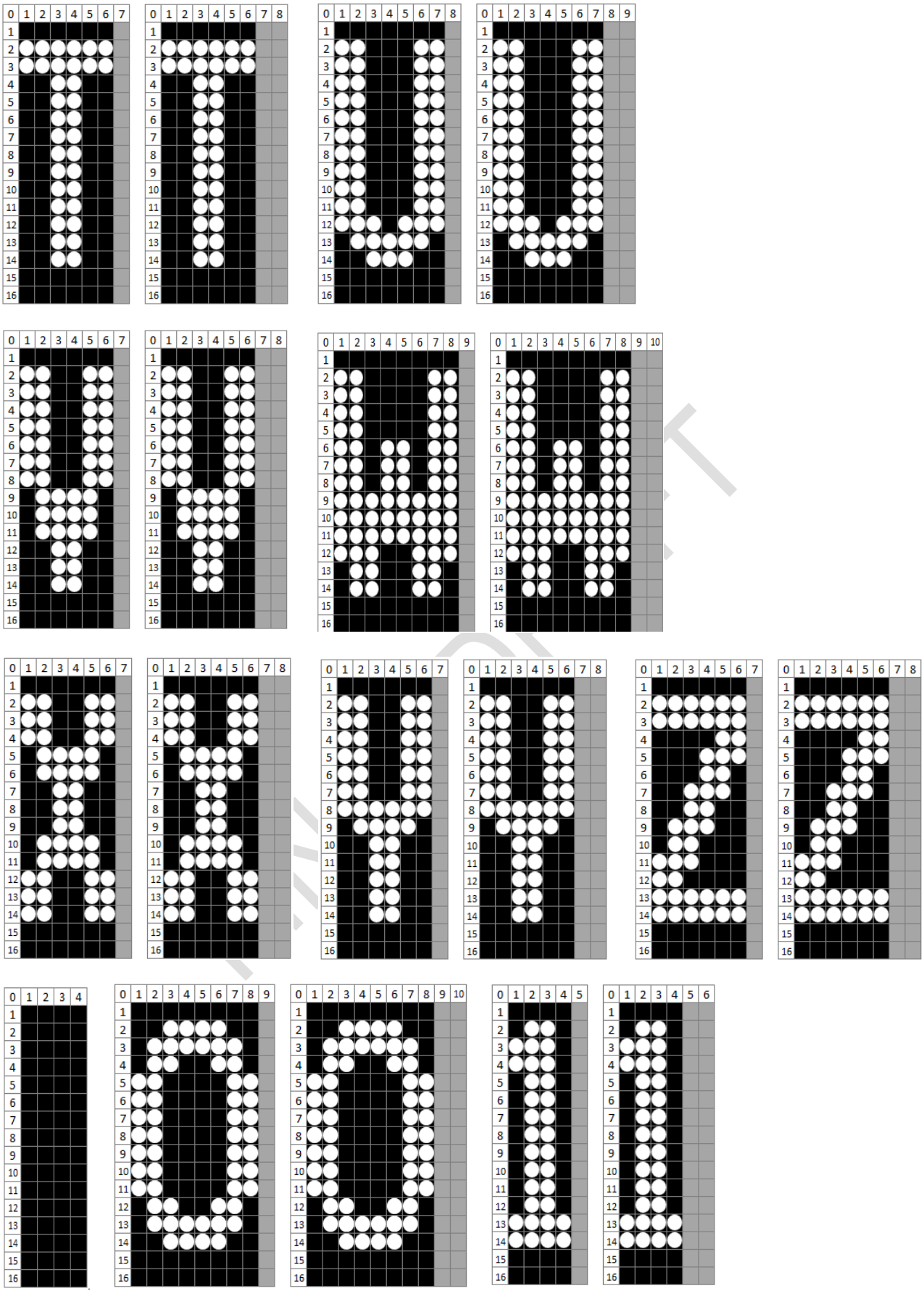

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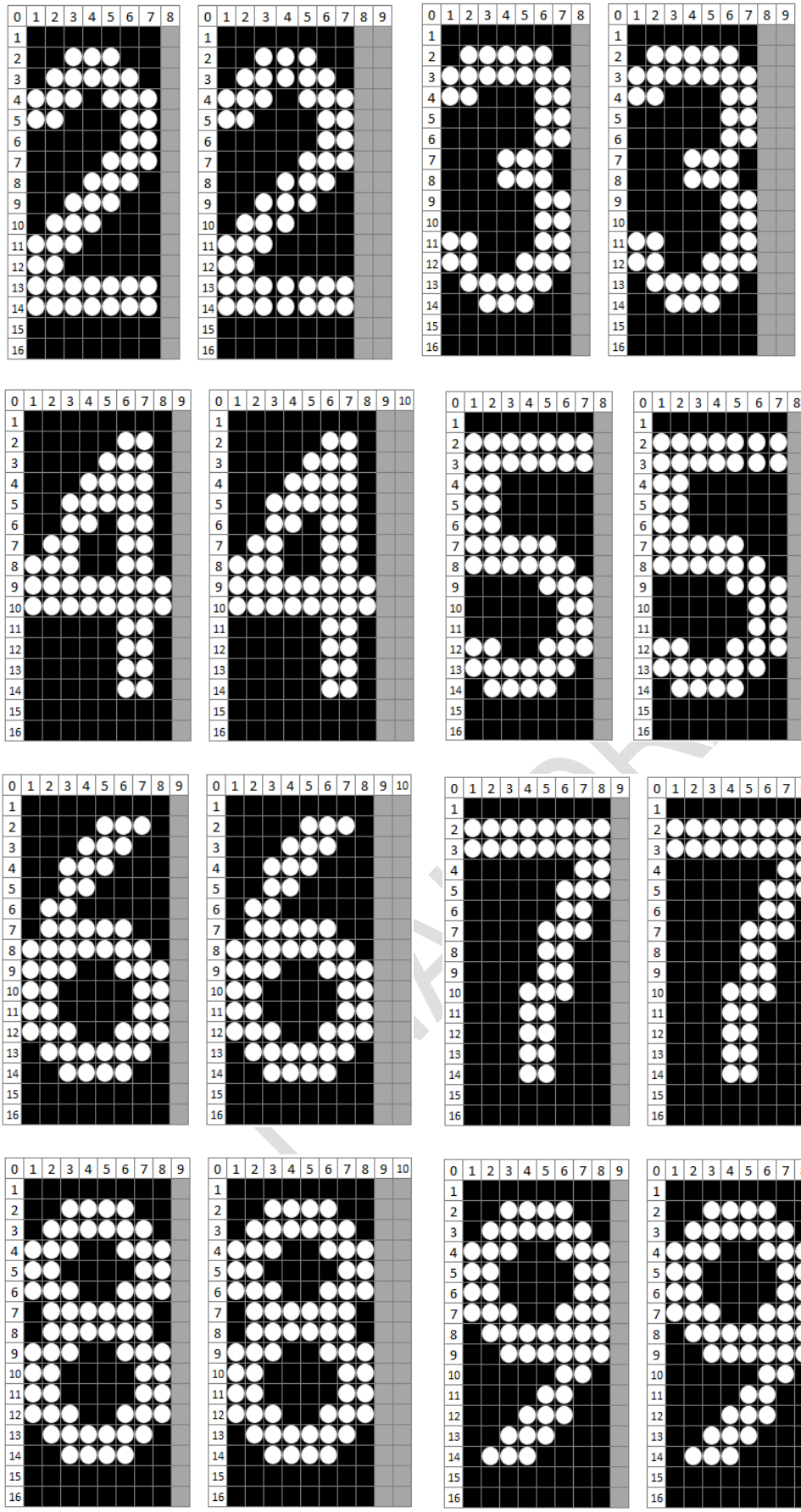

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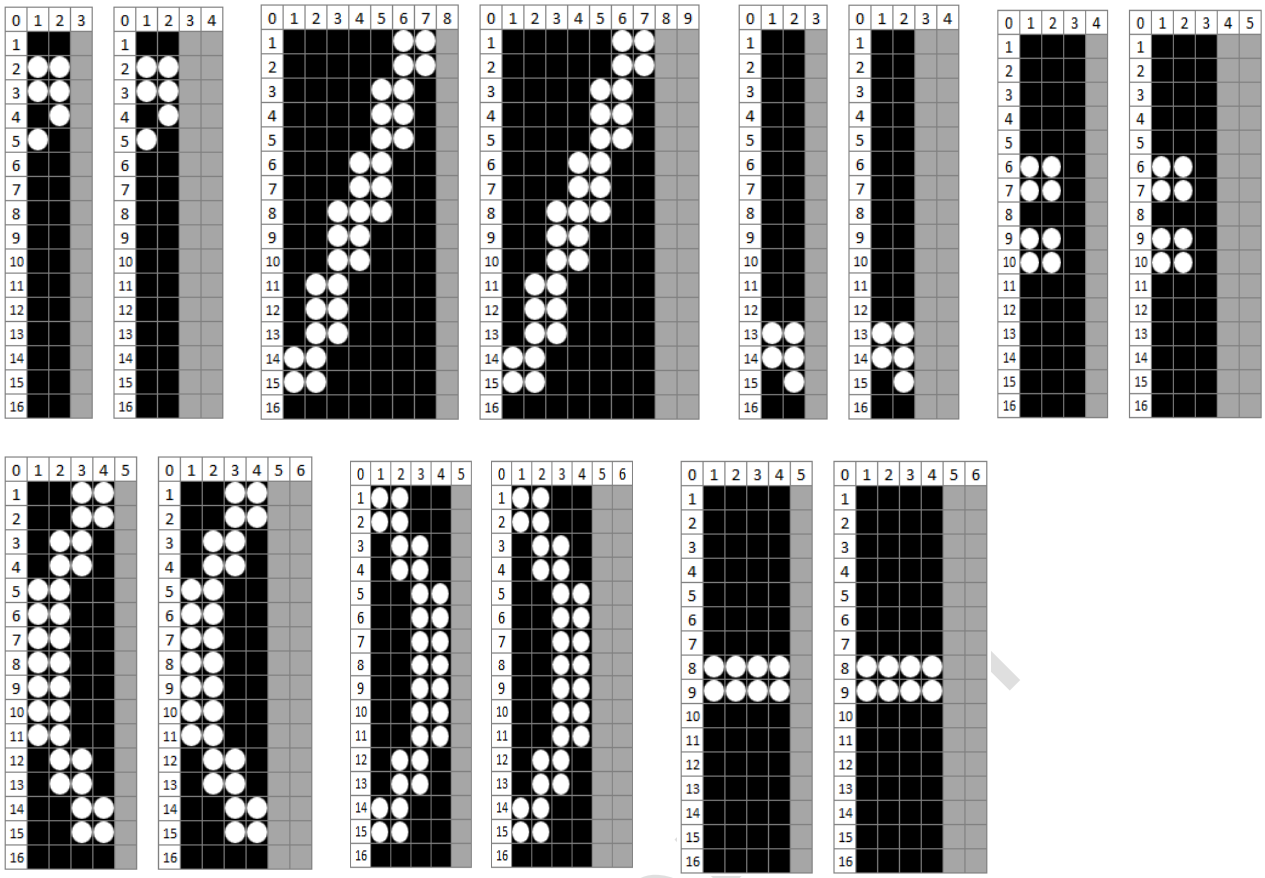

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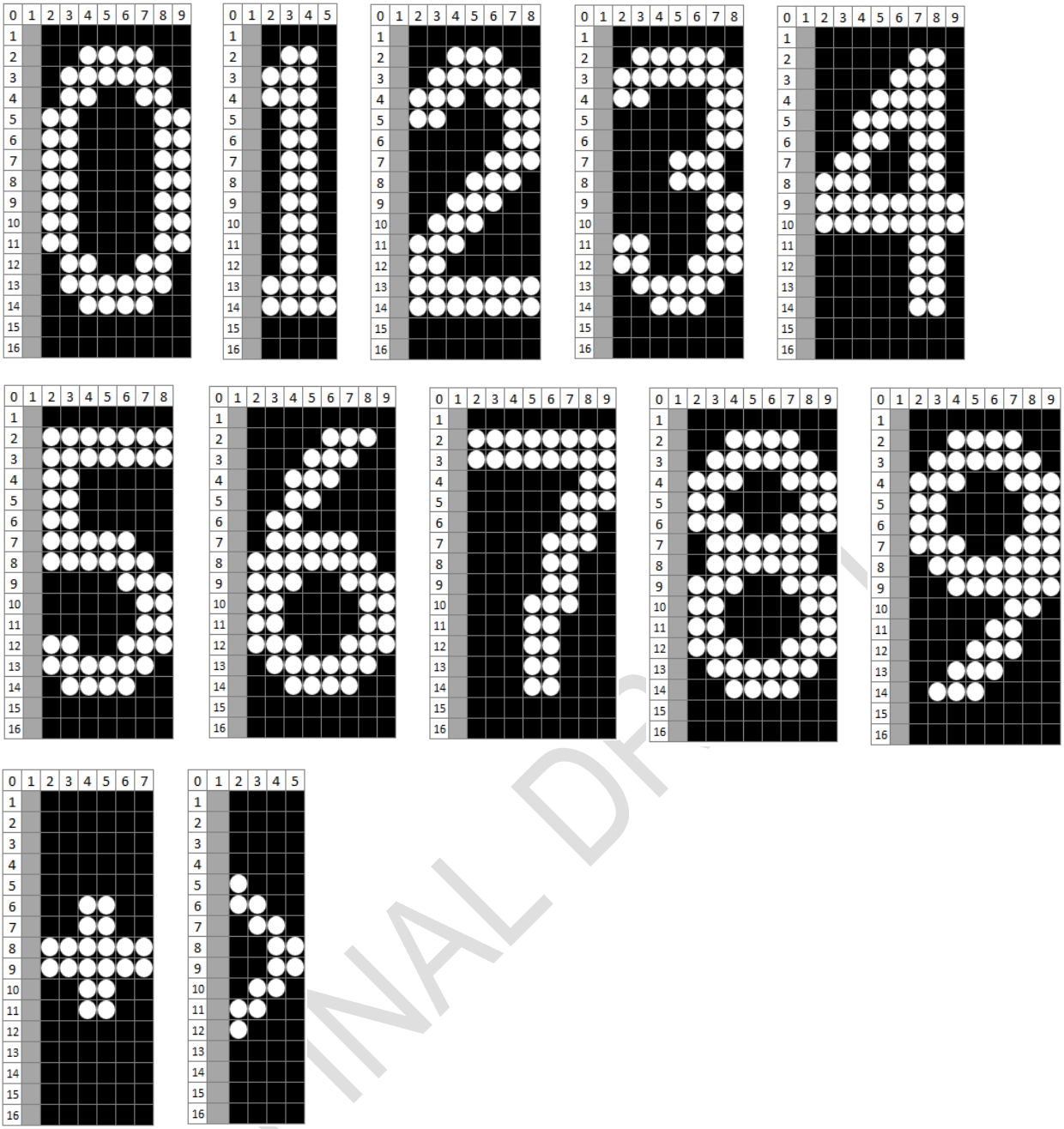

Figure 6. Urban type D VMS 200mm font maps

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7 REFERENCES

This section lists all external and NZTA references included in this document.

7.1 Industry standards

Standard number/name
AS 1744:2015 Standard alphabet for road signs (Series D)
EN 12966:2015+A1:2019 Road vertical signs – Variable message traffic signs

7.2 NZTA standards, specifications and resources

7.2.1 Standards and specifications

See the NZTA website for the latest versions of the ITS standards and specifications listed below.

Document name
ITS delivery specification: Lane and carriageway signs (LCS)
ITS delivery specification: Variable message signs – fixed
ITS design standard: Variable message signs – fixed

7.2.2 Resources

Document name/code
Land Transport Rule: Traffic Control Devices 2004 Rule 54002/2004 Updated 19 May 2022 (TCD Rule)

7.3 Other resources

Name
Health and Safety at Work Act 2015

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8 CONTENT TO BE REDIRECTED

This section records any circumstances where content from this document will be reclassified and moved into future documents. This table is then updated with a reference to the new location.

Section reference	Section name	Future document	Class

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9 TERMINOLOGY USED IN THIS DOCUMENT

Term	Definition
DRAFT	The document is being written and cannot be used outside of Waka Kotahi.
FINAL DRAFT (Pending ratification)	The document has been finalised and is pending approval and ratification by Waka Kotahi. It can be used for procurement at this status.
RATIFIED	The document is an official Waka Kotahi document. Waka Kotahi projects and other road controlling authorities connected to Waka Kotahi back-end systems must include this document in the contracts. The obligation to follow the requirements in this document would come from the inclusion of the S&S document in the contract.
RETIRED	The document is obsolete, and/or superseded.
NZTA	This is noted as being equivalent to the New Zealand Transport Agency.
Character height	Height of an uppercase character expressed in millimetres
Character spacing	Horizontal spacing between individual characters on the same line of a message. It is made up of the two spaces (margins) to the right of the first character and to the left of the next character.
Display matrix	Visible part of an electronic sign or signal which contains the pixels that can be activated to display the message
Expressway	High-speed roads, which may include well-spaced at-grade intersections – which means they often have accesses and driveways onto them and sometimes traffic signals or roundabouts
HVU	High-volume urban
ITS	Intelligent transport system(s)
LCS	Lane and carriageway sign(s) as specified in the latest version of the ITS delivery specification: Lane and carriageway signs (LCS)
Line spacing	Vertical space between lines of text, calculated as a percentage (between 0.4 and 0.6) of the uppercase font height and rounded to nearest number of pixels
Margin	Space of blank pixels to the left or right of a character
Message	Configuration consisting of symbols and/or text
Motorway	Access controlled, high-speed roads that normally have grade-separated intersections – which means they have overbridges (or underpasses) so road users do not have stop at traffic lights
Non-standard font	Any font that does not have font maps included in this standard
Pixel	Smallest controllable element of a display matrix for an electronic sign or signal
Pixel pitch	Distance between centres of adjacent pixels
RCA	Road controlling authority
Standard font	The font, which has font maps included in this standard
Stroke	Width of a line or curve that forms a character

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Term	Definition
TCD Rule	Land Transport Rule: Traffic Control Devices 2004
TOC	Transport operations centre
VMS	Variable message sign – an electronic sign where the information shown can be changed or switched on or off as required, as specified in the latest version of the ITS delivery specification: Variable message signs – fixed. The information can be text or symbols.

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10 DOCUMENT CONTROL

10.1 Document information

Document number	ITS-STND-FONT-202410
Previous document number/s (if applicable)	
Document status	FINAL DRAFT
[IF RETIRED] New document details	
Online ISBN	
Document availability	The controlled version of this document can be accessed from https://www.nzta.govt.nz/roads-and-rail/intelligent-transport-systems/standards-and-specifications/its-current-interim-and-legacy-standards-and-specifications/

10.2 Document owner

Role ITS S&S Steering Committee

Organisation NZTA

10.3 Document approvers

This table shows a record of the approvers for this document.

Approval date	Approver	Role	Organisation
DD/MM/YYYY			

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11 FULL VERSION HISTORY

This table shows the full history of changes made to this document, both minor and major, in chronological order, since the document was first authored.

Minor versions are numbered 0.1, 0.2 etc until such point as the document is approved and published, then it becomes 1.0 (major version). Subsequent edited versions become 1.1, 1.2 etc, or if it's a major update 2.0, and so on.

Version	Date	Author	Role and organisation	Reason
0.1	17/06/2022	Kirill Yushenko	Principal ITS Consultant, Resolve Group	First draft
0.2	15/07/2022	Final Word	Editorial services	Proofread first draft
0.3	16/08/2022	Kirill Yushenko	Principal ITS Consultant, Resolve Group	Addressed proofer's first draft comments, and comments from Ian Leach and Russell Pinchen
0.4	23.08.2022	Final Word	Editorial services	Proofread/update per author changes in version 0.3, further queries for author and Waka Kotahi
0.5	24.08.2022	Anandita Pujara	Document Manager	Added notes and comments to queries from proofer and author. Added content to be redirected
0.6	19/09/2022	Final Word	Editorial services	Update per author and Waka Kotahi answers to queries
0.7	22/11/2022	Kirill Yushenko	Principal ITS Consultant, Resolve Group	Implemented changes agreed post Expert review workshop
0.8	23/03/2022	Anandita Pujara	Document Manager	Updates made to link the document to SM0 series
0.9	26/04/23	Kirill Yushenko	Principal ITS Consultant, Resolve Group	Implemented changes agreed post industry review
0.10	08/05/2023	Matthew Bauer	Editor, Clear Edit NZ	Copyedit
0.11	09/05/2023	Kirill Yushenko	Principal ITS Consultant, Resolve Group	Addressed proofer's comments
0.12	11/05/2023	Matthew Bauer	Editor, Clear Edit NZ	Proofread final draft
0.13	19/05/2023	Anandita Pujara	Document Manager, Waka Kotahi	Changes to terminology definition

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Version	Date	Author	Role and organisation	Reason
0.14	6/06/2023	Anandita Pujara	Document Manager, Waka Kotahi	Updated section scope, purpose, and terminology
0.15	06/07/2023	Anandita Pujara	Document Manager, Waka Kotahi	Updated to clarify contractual roles as per ratification group feedback
0.16	30/07/2024	Peter Bathgate	Lead ITS Consultant, Diligent Consulting Ltd	Amended s4.3.2 and s8.4 (Type D urban font maps)
0.17	2/10/2024	Anandita Pujara	Document Manager, NZTA	Updated document control details

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