AN EVALUATION OF THE CONVERGING CHEVRON PAVEMENT MARKING PATTERN INSTALLATION ON INTERSTATE 94 AT THE MITCHELL INTERCHANGE South-to-West RAMP IN MILWAUKEE COUNTY, WISCONSIN

APPENDICES

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MARQUETTE
UNIVERSITY

Milwaukee, Wisconsin
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APPENDIX 1
Request for Authorization to Experiment with Chevron Pavement Markings

Wisconsin Department of Transportation

TRANSPORTATION DISTRICT 2
2000 Pewaukee Road, Suite A
P.O. Box 798
Waukesha, WI 53187-0798

Telephone (414) 548-5902
FAX (414) 548-8655

February 2, 1999

Mr. Rudy Umbs
Federal Highway Administration
Safety Design and Operations Division (HHS-10)
400 7th Street SW
Washington, D.C. 20590

Subject: Request for Authorization to Experiment with Chevron Pavement Markings

Dear Mr. Umbs:

The Wisconsin Department of Transportation requests approval to install an experimental **Converging Chevron Pavement Marking Pattern** to reduce speeds at a specific location in Milwaukee, the I-94 Westbound approach to the two-lane exit to the I-894 Westbound bypass.

The proposed pattern has been used in a number of locations in Japan. It consists of a series of white chevrons on the road surface with the spacing between chevrons decreasing as the driver travels over the pattern. Each chevron extends across only one lane of traffic. Therefore, in the proposed location, two side-by-side patterns would be installed. Traffic flow is in the direction indicated by the chevrons.

The illusion created by this pattern is intended to convince drivers that they are traveling faster than they really are and to create the impression that the road is narrowing. It is anticipated that these factors will contribute to reduced travel speeds. Although research has been conducted on other patterns of illusory pavement markings, we are unaware of any previous applications of the converging chevrons in the United States.

The relatively low cost and potential benefits of this application suggest that it could be an excellent traffic control device for speed reduction and safety. With your approval, we look forward to conducting this experiment in cooperation with the AAA Foundation for Traffic Safety and Dr. Robert Reinhardt of the Texas Transportation Institute.

If you need additional information, please call me at (414) 521-5348
or e-mail gary.knerr@dot.state.wi.us

Sincerely,

Gary P. Knerr, P.E.
Systems Operations Group Manager

cc: Peter Rusch, State Traffic Engineer
Thomas Loeffler, Bureau of Transportation Safety
William Bremer, FHWA Safety & Traffic Operations

DT1464

ATTACHMENT A

Instructions for setting out the converging chevron markings.

Figure 1 shows an installation of the chevrons in Japan (photo reversed for convenience). The proposed layout will be derived from this example. The right two lanes in the photo will be what the north bound traffic on the IH-94 approach to the westbound ramp would see. The one point about the photo to be stressed is that while the on coming traffic to the left has four chevrons per set and the out bound traffic on the right appears to have 6 or 8 chevrons per set, EACH SET IN THE PROPOSED APPLICATION WILL HAVE 10 CHEVRONS.

This determination was made based on the anti-skid characteristics of this pattern and the relatively high rate of speed at the site. The number of chevrons per set has to do with the speed within the pattern and the current application calls for 10 chevrons per set.

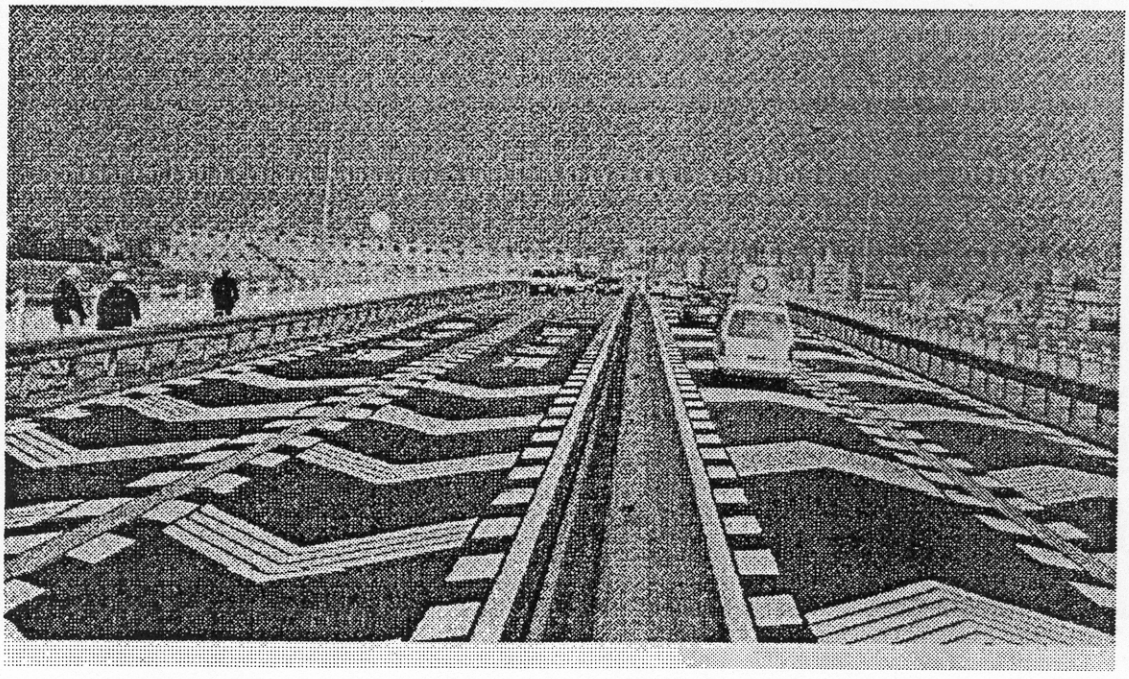


Figure 1. Converging chevrons on Yodogawa River Bridge .

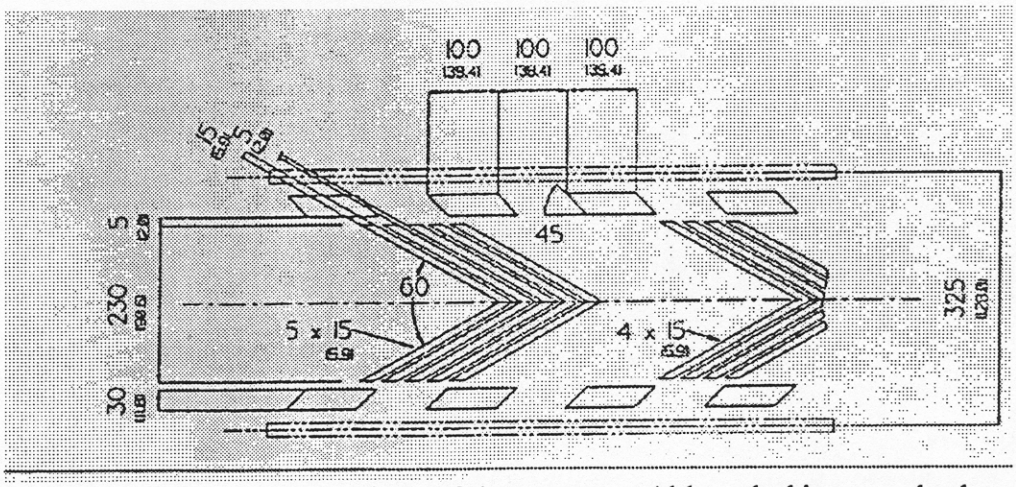


Figure 2 indicates the actual dimensions of the patterns. Although this example shows sets of 5 (left) and 4 (right) chevrons per set, as stated above, all sets will have 10 chevrons of 15cm each.

The length of an individual chevron pattern is based on certain enabling assumptions. These assumptions include the initial speed of vehicles entering the pattern (v_1), the desired speed upon leaving the pattern (v_2), reaction time (the time that elapses prior to braking), typically 0.5s (t_b), and constant deceleration once brakes are applied (a). The pattern length for the current application was calculated as follows:

Pattern Length Calculation

$$L = v_1 t_b + \frac{(v_1^2 - v_1^2)}{2a}$$

v_1 = speed entering pattern = 95.33 fps (65 MPH)

v_2 = speed exiting pattern = 73.33 fps (50 MPH)

t_b = reaction time = .5sec

a = deceleration braking = $3.3 fps^2$

$$L = (95.33) * .5 + \frac{(95.33^2 - 73.33^2)}{6.6} = 610 \text{ feet}$$

Average speed in pattern = 84.33 fps (57.5MPH)

$$\text{Time to traverse pattern} = \frac{610}{84.33} = 7.2 \text{ Sec}$$

Number of chevron sets (at 2.2 per second) = 15.8

@ 2.2/sec = 1 pattern every .4545 seconds

$$\text{Uniform deceleration} = \frac{95.33 - 73.33}{6.7*} = 3.28\text{fps or the 3.3fps used initially}$$

Deceleration per chevron = 3.3 * .4545 = 1.49885fps, call it 1.5

* 7.2 total - .5 reaction time

Pattern Size

The spacing of the patterns is dependent on the pattern size which is itself a function of the number of individual stripes making up the pattern. Since each set of chevrons will have 10 individual stripes the size of each set of chevrons is the same.

Given: 15cm (5.9in) wide stripes and 5cm (2 in) wide spaces.
Given: 60 degree (30 degrees either side of center line)

To determine running length along highway:

$$\text{Sine } 30 = \frac{15\text{cm}}{X} \qquad .5 = \frac{15\text{cm}}{X}$$

x = 30 cm for Stripes, 10cm for spaces.

One stripe and space = 40cm

From beginning of first stripe to end of last stripe in a 10 set pattern would be:

(9 * 40) + 30 = 390cm or 12' 9.5"

Pattern Spacing

While it is possible to calculate pattern spacing such that the distance between each set of chevrons is a constantly decreasing length, the practicality of installing this type pattern and the actual ability of drivers to perceive this precision make it impractical. Therefore an approximation that keeps the drivers within the marked portion of the pattern for an increasingly longer time (from .14 sec to .18sec) was chosen, which duplicates the Japanese application of these markings.

Given that the last set needs to be completed prior to the detector loop, that loop will act as the reference point. At the anticipated speeds involved, the maximum distance between the end of the pattern and the loop detector should be 40 feet. This would allow approximately ½ second to pass between the end of the pattern and the detector. Using this 40 foot mark as the ending point of the pattern, the following table gives the positions of the 16 sets of markings (negative numbers indicating up stream distances in advance of the loop detector.)

SET	DISTANCE
1	-618
2	-576
3	-534
4	-492
5	-450
6	-410
7	-370
8	-330
9	-292
10	-254
11	-216
12	-180
13	-144
14	-108
15	-74
16	-40

The actual point within the pattern (front, center, etc.) where the distance measurement is made is arbitrary as long as it is consistent.

APPENDIX 2
Sample Wisconsin Motor Vehicle Accident Report (form MV 4000)

Amended Document ◯ On Emergency

5589556

Wisconsin Motor Vehicle Accident Report

Please Do Not Write In This Microfilm Space

Document Number Override 0

INSTRUCTIONS
Please use a Black Ink Pen or #2 Pencil.
Mark Areas as shown:
Correct Mark ●
Incorrect Marks ⊘ ⊗ ◒ ◉

Reportable Accident 1 (Y) (N)

County 2

MUN/TWP 3

Accident Date
MONTH: Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
DAY 4
YEAR 9 (1990)

Time of Accident (Military Time)
HOUR 5
MIN.

Total Number
UNITS 6
INJURED 7
KILLED 8

Hit & Run (Y) (N)
Government Property (Y) (N)
Fire (Narrative) (Y) (N)
Photos Taken (Narrative) (Y) (N)
Trailer or Towed (Narrative) (Y) (N)
Truck or Bus (Last Page) (Y) (N)
Load Spillage (Y) (N)
Construction Zone (Y) (N)
Names Exchanged 9 (Y) (N)

Sheet No. Of 10

ACCIDENT LOCATION
◯ Public Highway, Intersection/Related
◯ Public Highway, Non-Intersection
◯ Parking Lot
◯ Private Property or Road
11

LATITUDE (GPS) Degrees: 12 Minutes: Seconds:

LONGITUDE (GPS) Degrees: 13 Minutes: Seconds:

◆ ON Hwy No. and / Street Name 14

Estimated ◯ FT. ◯ MI. (N) (W) (E) (S) 15

◆ FROM/AT Hwy No. and / Street Name 16

◯ House # ◯ Fire # ◯ Other ◯ Utility # ◯ Railroad # 17

Agency Space 18

Special Study 19 (1) (2) (3) (4)

Unit 1

Unit Number 20
Unit Type 21
Total Number of Occupants 22
Direction of Travel (Before the Accident) 23

Speed Limit 24
OPERATOR NAME Last First M.I. 25
ADDRESS Street & Number 26
City & State 27 ZIP Phone Number 28
Driver's License Number 29 State 30 Exp. Year 31
Date of Birth 32
Sex (M) (F) 33
Operating as Classified: 36
Class (Mark Only One) (A) (D) (B) (M) (C) (O)
Endorse (Mark All That Apply) (H) (P) (T) (N) (S) (F) 37
On Duty Accident 34 (P) Police (E) EMT—Paramedic (F) Fire Fighter (H) Winter Hwy Maintenance
CMV (Y) (N) 35
Severity (K) (N) (A) (B) (C) 38
SEAT Position 39
SAFETY Equipment 40
AIRBAG 41 (1) Deployed (2) Non Deployed (3) Not Applicable (4) Unknown
EJECTED 42 (1) Not Applicable (2) Not Ejected (3) Totally Ejected (4) Partially Ejected (5) Unknown
TRAPPED/EXTRICATED 43 (1) Not Applicable (2) Not Trapped (3) Trapped/Extricated (4) Trapped/Not Extricated (5) Unknown
Medical Transport 44 (Y) (N)
Vehicle Owner 45 Same (Y) (N)
Last Name First M.I. 46
Street Address 47
City & State 48 ZIP Phone Number 49
Year of Vehicle 50 Make 51 Model 52 Body Style 53 Color 54
Vehicle ID Number 55
License Plate Number 56 Plate Type 57 State 58 Exp. Year 59
Policy Holder's Name Same 60 (Y) (N) 61
Citation 62 (0) (1) (2) (3)
Liability Insurance Company 63 Stat. # 64

Unit 2

Unit Number 20
Unit Type 21
Total Number of Occupants 22
Direction of Travel (Before the Accident) 23

Speed Limit 24
OPERATOR NAME Last First M.I. 25
ADDRESS Street & Number 26
City & State 27 ZIP Phone Number 28
Driver's License Number 29 State 30 Exp. Year 31
Date of Birth 32
Sex (M) (F) 33
Operating as Classified: 36
Class (Mark Only One) (A) (D) (B) (M) (C) (O)
Endorse (Mark All That Apply) (H) (P) (T) (N) (S) (F) 37
On Duty Accident 34 (P) Police (E) EMT—Paramedic (F) Fire Fighter (H) Winter Hwy Maintenance
CMV (Y) (N) 35
Severity (K) (N) (A) (B) (C) 38
SEAT Position 39
SAFETY Equipment 40
AIRBAG 41 (1) Deployed (2) Non Deployed (3) Not Applicable (4) Unknown
EJECTED 42 (1) Not Applicable (2) Not Ejected (3) Totally Ejected (4) Partially Ejected (5) Unknown
TRAPPED/EXTRICATED 43 (1) Not Applicable (2) Not Trapped (3) Trapped/Extricated (4) Trapped/Not Extricated (5) Unknown
Medical Transport 44 (Y) (N)
Vehicle Owner 45 Same (Y) (N)
Last Name First M.I. 46
Street Address 47
City & State 48 ZIP Phone Number 49
Year of Vehicle 50 Make 51 Model 52 Body Style 53 Color 54
Vehicle ID Number 55
License Plate Number 56 Plate Type 57 State 58 Exp. Year 59
Policy Holder's Name Same 60 (Y) (N) 61
Citation 62 (0) (1) (2) (3)
Liability Insurance Company 63 Stat. # 64

Occupant

Occupant Unit Number (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) 65
NAME Last First M.I. 66
ADDRESS Street & Number City & State ZIP 68
Date of Birth 67
Sex (M) (F) 69
Severity (K) (N) (A) (B) (C) 70
SEAT Position 71
SAFETY Equipment 72
AIRBAG 73 (1) Deployed (2) Non Deployed (3) Not Applicable (4) Unknown
Address Same as Operator (Y) Yes (N) No 74
EJECTED 75 (1) Not Applicable (2) Not Ejected (3) Totally Ejected (4) Partially Ejected (5) Unknown
TRAPPED/EXTRICATED 76 (1) Not Applicable (2) Not Trapped (3) Trapped/Extricated (4) Trapped/Not Extricated (5) Unknown
Medical Transport 77 (Y) (N)
Agency Space 78

MV4000 1293

EMS Number 79

Accident No. Police No. Date Location

Occupant Unit Number

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Address Same as Operator ◯ Yes ◯ No

NAME Last First M.I. | Date of Birth | Sex Ⓜ Ⓕ | Severity Ⓚ Ⓝ Ⓐ Ⓑ Ⓒ | SEAT Position | SAFETY Equipment | AIRBAG ① Deployed ② Non Deployed ③ Not Applicable ④ Unknown

ADDRESS Street & Number City & State ZIP

EJECTED ① Not Applicable ② Not Ejected ③ Totally Ejected ④ Partially Ejected ⑤ Unknown

TRAPPED/EXTRICATED ① Not Applicable ② Not Trapped ③ Trapped/Extricated ④ Trapped/Not Extricated ⑤ Unknown

Medical Transport Ⓨ Ⓝ

Agency Space

Occupant Unit Number

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Address Same as Operator ◯ Yes ◯ No

NAME Last First M.I. | Date of Birth | Sex Ⓜ Ⓕ | Severity Ⓚ Ⓝ Ⓐ Ⓑ Ⓒ | SEAT Position | SAFETY Equipment | AIRBAG ① Deployed ② Non Deployed ③ Not Applicable ④ Unknown

ADDRESS Street & Number City & State ZIP

EJECTED ① Not Applicable ② Not Ejected ③ Totally Ejected ④ Partially Ejected ⑤ Unknown

TRAPPED/EXTRICATED ① Not Applicable ② Not Trapped ③ Trapped/Extricated ④ Trapped/Not Extricated ⑤ Unknown

Medical Transport Ⓨ Ⓝ

Agency Space

Type of Accident

First Harmful Event 80

Most Harmful Event

Unit Number		Unit Number
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	81	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

(select one per vehicle)

Collision With Object Not Fixed

①	Motor Vehicle in Transport	①
②	Parked Motor Vehicle	②
③	Deer	③
④	Pedalcycle	④
⑤	Pedestrian	⑤
⑥	Railway Train	⑥
⑦	Other Animal	⑦
⑧	Motor Vehicle in Transport In Other Roadway	⑧
⑨	Other Object (Not Fixed)	⑨

Collision With Fixed Object

⑩	Traffic Sign Post	⑩
⑪	Traffic Signal	⑪
⑫	Utility Pole	⑫
⑬	Lum. Light Support	⑬
⑭	Other Post	⑭
⑮	Tree	⑮
⑯	Mailbox	⑯
⑰	Guardrail Face	⑰
⑱	Guardrail End	⑱
⑲	Median Barrier	⑲
⑳	Bridge Parapet End	⑳
㉑	Bridge/Pier/Abut.	㉑
㉒	Impact Attenuator	㉒
㉓	Overhead Sign Post	㉓
㉔	Bridge Rail	㉔
㉕	Culvert	㉕
㉖	Ditch	㉖
㉗	Curb	㉗
㉘	Embankment	㉘
㉙	Fence	㉙
㉚	Other Fixed Object	㉚
㉛	Unknown	㉛

Non-Collision

㉜	Overturn	㉜
㉝	Fire/Explosion	㉝
㉞	Immersion	㉞
㉟	Jackknife	㉟
㊱	Other Non-Collision	㊱

Driver Condition

Unit Number		Unit Number
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩		① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

88 **Driver Factors (Or Pedestrians)**

①	Appeared Normal	①
②	Reduced Alertness	②
③	Ability Impaired	③
④	Not Observed	④

89 **Presence**

⑤	Neither Alcohol nor Drugs Present	⑤
⑥	Yes—Alcohol Present	⑥
⑦	Yes—Drugs Present	⑦
⑧	Yes—Alcohol & Drugs Present	⑧
⑨	Unknown	⑨

90 **Alcohol**

AC Value | AC Value

⑩	Test Not Given	⑩
⑪	Test Refused	⑪
⑫	Test Given, Alcohol Unknown	⑫
⑬	Test Given, No Alcohol Reported	⑬

91 **Drugs**

⑭	Test Not Given	⑭
⑮	Test Refused	⑮
⑯	Test Given, Drugs Unknown	⑯
⑰	Test Given, No Drugs Reported	⑰
⑱	Drugs Reported (Specify Below)	⑱
⑲	Marijuana	⑲
⑳	Cocaine	⑳
㉑	Opiates	㉑
㉒	Amphetamines	㉒
㉓	PCP	㉓
㉔	Other Drug Medication	㉔
㉕	Type Unknown	㉕

Unit # ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Pedestrian 92

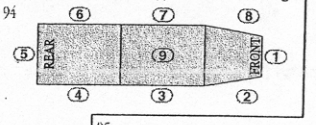
Location	Action
① In Crosswalk	① Walking not Facing Traffic
② In Roadway	② Disregarded Signal
③ Not in Roadway	③ Darting into Road
④ On Sidewalk	④ Dark Clothing
	⑤ Walking Facing Traffic

Manner of Collision 93

① No Collision with Motor Vehicle in Transport
② Rear-end
③ Head On
④ Rear to Rear
⑤ Angle
⑥ Sideswipe, Same Direction
⑦ Sideswipe, Opposite Direction
⑧ Unknown

Unit # ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Darken Numbered Area(s) of Vehicle Damage 94



⓪ None
⑩ Undercarriage
⑪ Total (Damage to all Areas)
⑫ Other
⑬ Unknown

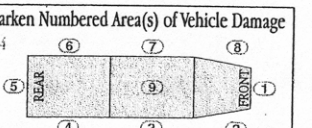
95 **Extent of Damage**

⓪ None ④ Severe
① Very Minor ⑤ Very Severe
② Minor ⑥ Unknown
③ Moderate

Vehicle Towed Due to Damage! Ⓨ Ⓝ 96 | Vehicle Removed By: 97

Unit # ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Darken Numbered Area(s) of Vehicle Damage 94



⓪ None
⑩ Undercarriage
⑪ Total (Damage to all Areas)
⑫ Other
⑬ Unknown

95 **Extent of Damage**

⓪ None ④ Severe
① Very Minor ⑤ Very Severe
② Minor ⑥ Unknown
③ Moderate

Vehicle Towed Due to Damage! Ⓨ Ⓝ 96 | Vehicle Removed By: 97

Fixed Object Struck

Unit	Unit	Unit	Unit	Unit	Unit
82					

Govt. Damage Tag # 83

PROPERTY OWNER Last First M.I. 84

ADDRESS Street & Number 85

City & State 86 ZIP Phone Number ( ) 87

98 Draw Diagram of Accident & Indicate North with an arrow in the circle.

99 **Pictorial Representation of Narrative**

Supplemental Reports 101 (Y) (N) | Witness Statements 102 (Y) (N) | Measurements Taken 103 (Y) (N)

Skidmarks to Impact: Unit 1 ____ 100 FEET ____ Unit 2

Surface Type: _____

NARRATIVE

104 _____

106 Power Unit # _____ Trailer Make _____ Towed Unit _____ VIN _____

License Plate # _____ Plate Type _____ State _____ Exp. Yr. _____

Photos By: 105

WITNESS NAME 107 — Last _____ First _____ M.I. _____

ADDRESS 108 — Street & Number _____ Date of Birth 109 _____

City & State 110 _____ ZIP _____ Phone Number 111 ( )

ACCESS CONTROL 112
1. No Control (Unlimited Access)
2. Full Control (Only Ramp Entry/Exit)
3. Partial Control

ROAD TERRAIN 113
Part A
1. Straight
2. Curve

Part B
3. Level/Flat
4. Hill

LIGHT CONDITION 114
1. Daylight
2. Dark–Not Lighted
3. Dark–Lighted
4. Dawn
5. Dusk
6. Unknown

TRAFFIC WAY 115
1. Not Physically Divided (2-Way Traffic)
2. Divided Highway, Median Strip, without Traffic Barrier
3. Divided Highway, Median Strip, with Traffic Barrier
4. One-Way Traffic
5. Parking Lot or Private Property

ROAD SURFACE CONDITION 116
1. Dry
2. Wet
3. Snow/Slush
4. Ice
5. Sand, Mud, Dirt, Oil
6. Other
7. Unknown

WEATHER 118
1. Clear
2. Cloudy
3. Rain
4. Snow
5. Fog, Smog, Smoke
6. Sleet, Hail (Freezing Rain or Drizzle)
7. Blowing Sand, Soil, Dirt, Snow
8. Severe Crosswinds
9. Other
10. Unknown

RELATION TO ROADWAY 117
1. On Roadway
2. Parking Lot or Private Property
3. Shoulder (Other than Shoulder within Median or Gore)
4. Median (Other than Median within Gore)
5. Outside Shoulder–Left
6. Outside Shoulder–Right
7. Off Roadway–Location Unknown
8. Gore (Area between Ramp & Highway)
9. On Ramp
10. Unknown

What Drivers Were Doing

Unit Number 1 2 3 4 5 / 6 7 8 9 10	119	Unit Number 1 2 3 4 5 / 6 7 8 9 10
1	Going Straight	1
2	Making Left Turn	2
3	Making Right Turn	3
4	Slowing or Stopping	4
5	Stopped in Traffic	5
6	Legally Parked	6
7	Violating No Passing Zone	7
8	Illegally Parked	8
9	Parking Maneuver	9
10	Backing Maneuver	10
11	Changing Lanes	11
12	Overtaking on left	12
13	Overtaking on right	13
14	Making U Turn	14
15	Turning on red	15
16	Merging	16
17	Negotiating Curve	17
18	Other	18

Traffic Control

Unit Number 1 2 3 4 5 / 6 7 8 9 10	120	Unit Number 1 2 3 4 5 / 6 7 8 9 10
1	No Control	1
2	Traffic Signal Operating	2
3	Traffic Signal Flashing	3
4	Stop Sign	4
5	Stop Sign with Flasher	5
6	Warning	6
7	Warn sign with Flasher	7
8	Yield Sign	8
9	Traffic Control Person	9
10	RR-xing Signal	10
11	Other	11

5589556

Document Number Override 121

Officer's Opinion of Possible Contributing Circumstances

Driver Factors

Unit Number (1 2 3 4 5 / 6 7 8 9 10) 122 N/A | Unit Number (1 2 3 4 5 / 6 7 8 9 10) N/A

1	Exceeding Speed Limit	1
2	Speed too Fast/Condition	2
3	Fail to Yield Right of Way	3
4	Inattentive Driving	4
5	Following too Close	5
6	Improper Turn	6
7	Left of Center	7
8	Disregarded Traffic Control	8
9	Improper Overtaking	9
10	Unsafe Backing	10
11	Failure to have Control	11
12	Driver Condition	12
13	Physically Disabled	13
14	Other	14

Vehicle Factors

Unit Number (1 2 3 4 5 / 6 7 8 9 10) 123 N/A | Unit Number (1 2 3 4 5 / 6 7 8 9 10) N/A

1	Brake System	1
2	Tires	2
3	Steering System	3
4	Turn Signals	4
5	Head Lamps	5
6	Stop Lamps	6
7	Tail Lamps	7
8	Disabled in Prior Accident	8
9	Other Disabled	9
10	Mirrors	10
11	Suspension System	11
12	Other	12

Highway Factors

Unit Number (1 2 3 4 5 / 6 7 8 9 10) 124 N/A | Unit Number (1 2 3 4 5 / 6 7 8 9 10) N/A

1	Snow, Ice or Wet	1
2	Narrow shoulder	2
3	Low Shoulder	3
4	Soft Shoulder	4
5	Loose Gravel	5
6	Rough Pavement	6
7	Debris from Prior Accident	7
8	Other Debris	8
9	Sign Obscured or Missing	9
10	Narrow Bridge	10
11	Construction Zone	11
12	Visibility Obscured	12
13	Other	13

OFFICER INFORMATION

Last 125 | First | M.I.

Law Enforcement Agency Address 126

City & State 127 | ZIP

Phone Number ( ) 128

Agency # 129 | Enforcement Agency 130 | Officer ID # 131

Date Notified

MONTH	DAY	YEAR
Jan		9
Feb 132		
Mar	0 0	199 0
Apr	1 1	1
May	2 2	2
June	3 3	3
July	4	4
Aug	5	5
Sept	6	6
Oct	7	7
Nov	8	8
Dec	9	9

Time Notified (Military Time)

HOUR	MIN.
133	
0 0	0 0
1 1	1 1
2 2	2 2
	3 3
	4 4
	5 5
	6
	7
	8
	9

Time Arrived (Military Time)

HOUR	MIN.
134	
0 0	0 0
1 1	1 1
2 2	2 2
	3 3
	4 4
	5 5
	6
	7
	8
	9

Date of Report

MONTH	DAY	YEAR
Jan		9
Feb	135	
Mar	0 0	199 0
Apr	1 1	1
May	2 2	2
June	3 3	3
July	4	4
Aug	5	5
Sept	6	6
Oct	7	7
Nov	8	8
Dec	9	9

Truck & Bus Accident Information

(This Section Must Be Completed for Each Truck or Bus Involved in this Accident.).

When To Use This Section: *Did the accident involve:. . .* 136

Part A
- A truck with at least two axles and six tires? (Y) (N)
- A truck with a hazardous materials placard? (Y) (N)
- A bus designed to carry 16 or more persons, including the driver? (Y) (N)

STOP! If all the responses to Part A are "NO" do not complete this Truck & Bus Accident Information Section. If there are any "YES" answers, continue to Part B.

Part B
- Any person who was fatally injured? (Y) (N)
- Any injured person requiring transport for immediate medical treatment? (Y) (N)
- One or more vehicles that had to be towed from the scene as a result of the accident? (Y) (N)
- One or more vehicles that required repair or were provided assistance before proceeding from scene under own power? (Y) (N)

STOP! If all the responses to Part B are "NO" do not continue. If there are any "YES" answers, please complete this Truck & Bus Accident Information Section . . .

Hazardous Material Information

137
- Hazardous Material Class Numbers (1-2digit):
- Hazardous Material "UN" Numbers (4 digit):
- Hazardous Material Placard Displayed? (Y) (N)
- Hazardous Cargo was Released? (Y) (N)

List the Hazardous Material(s) by name in this load:

List the Name(s) of Released Hazardous Material(s):

Carrier Information

• Interstate Carrier? (Y) (N) 138

Carrier Name 139

Carrier Identification Numbers

US DOT 140	LC
ICC MC	IC

Carrier Address 142

Source: 141
- Vehicle Side
- Shipping Papers
- Trip Manifest
- Driver
- Log Book

Vehicle Information

Gross Vehicle Weight Rating 143 LBS | Total # of Axles 144

Vehicle Configuration 145
1. Bus
2. Single unit truck, 2 axles, 6 tires
3. Single unit truck 3+ axles
4. Truck/Trailer
5. Truck/Tractor
6. Tractor/Semi-Trailor
7. Tractor/Doubles
8. Tractor/Triples
9. Unknown Heavy Truck
10. Log Truck

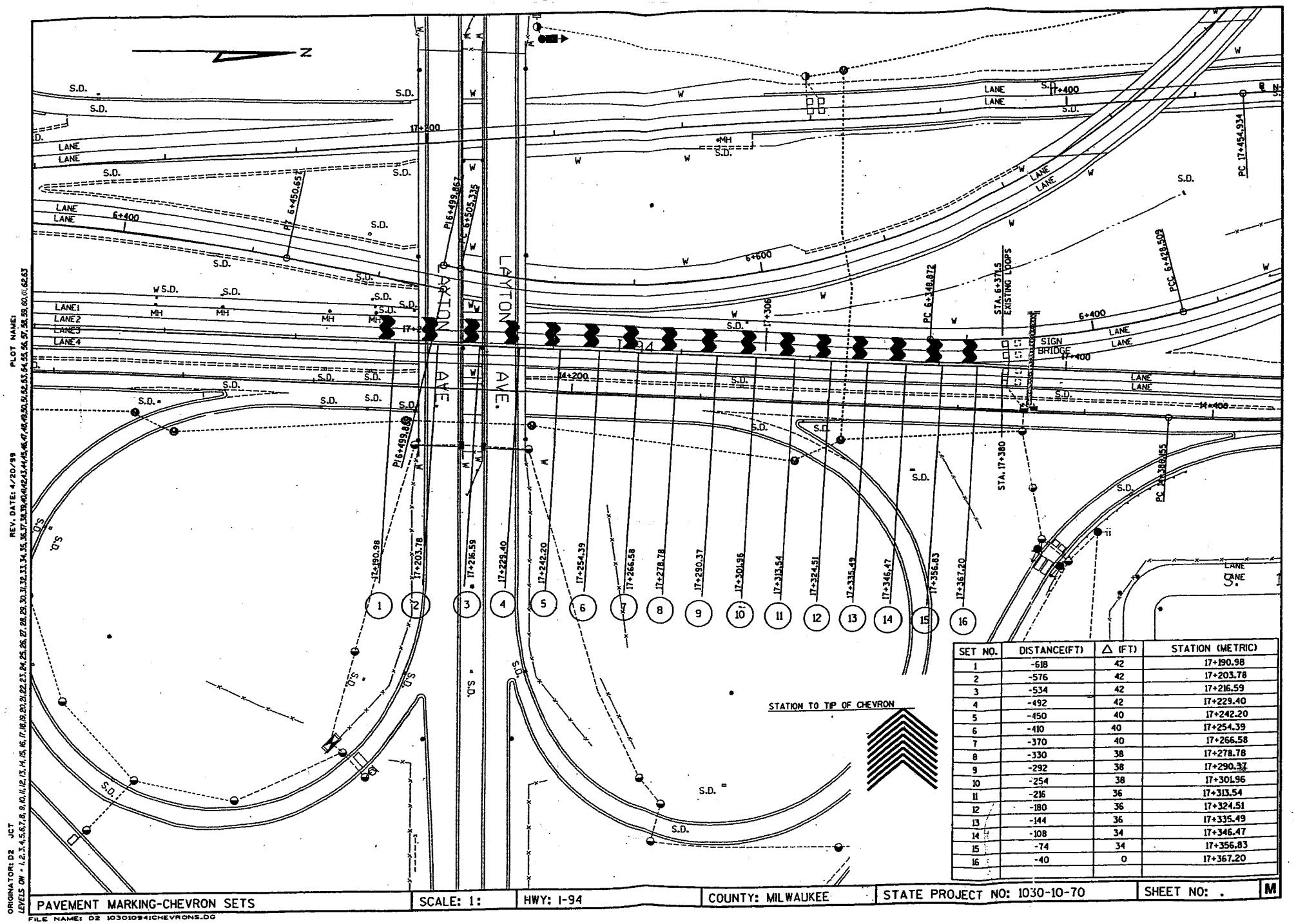
SEQUENCE OF EVENTS FOR THIS VEHICLE 146 *(Mark a total of one to four events in the order that they occurred.)*

(1) (2) (3) (4) Ran off Road	(1) (2) (3) (4) Collision involving motor vehicle in transp.
(1) (2) (3) (4) Jackknife	(1) (2) (3) (4) Collision involving parked motor vehicle
(1) (2) (3) (4) Overturn (Rollover)	(1) (2) (3) (4) Collision involving train
(1) (2) (3) (4) Downhill Runaway	(1) (2) (3) (4) Collision involving pedalcycle
(1) (2) (3) (4) Cargo Loss or Shift	(1) (2) (3) (4) Collision involving animal
(1) (2) (3) (4) Explosion or Fire	(1) (2) (3) (4) Collision involving fixed object
(1) (2) (3) (4) Separation of Units	(1) (2) (3) (4) Collision involving other object
(1) (2) (3) (4) Collision involving pedestrian	(1) (2) (3) (4) Other

Cargo Body Type 147
1. Bus
2. Van/Enclosed box
3. Cargo Tank
4. Flatbed
5. Dump
6. Concrete Mixer
7. Auto Transporter
8. Garbage/Refuse
9. Other
10. Log Truck

APPENDIX 3
Converging Chevron Installation Geometric Details

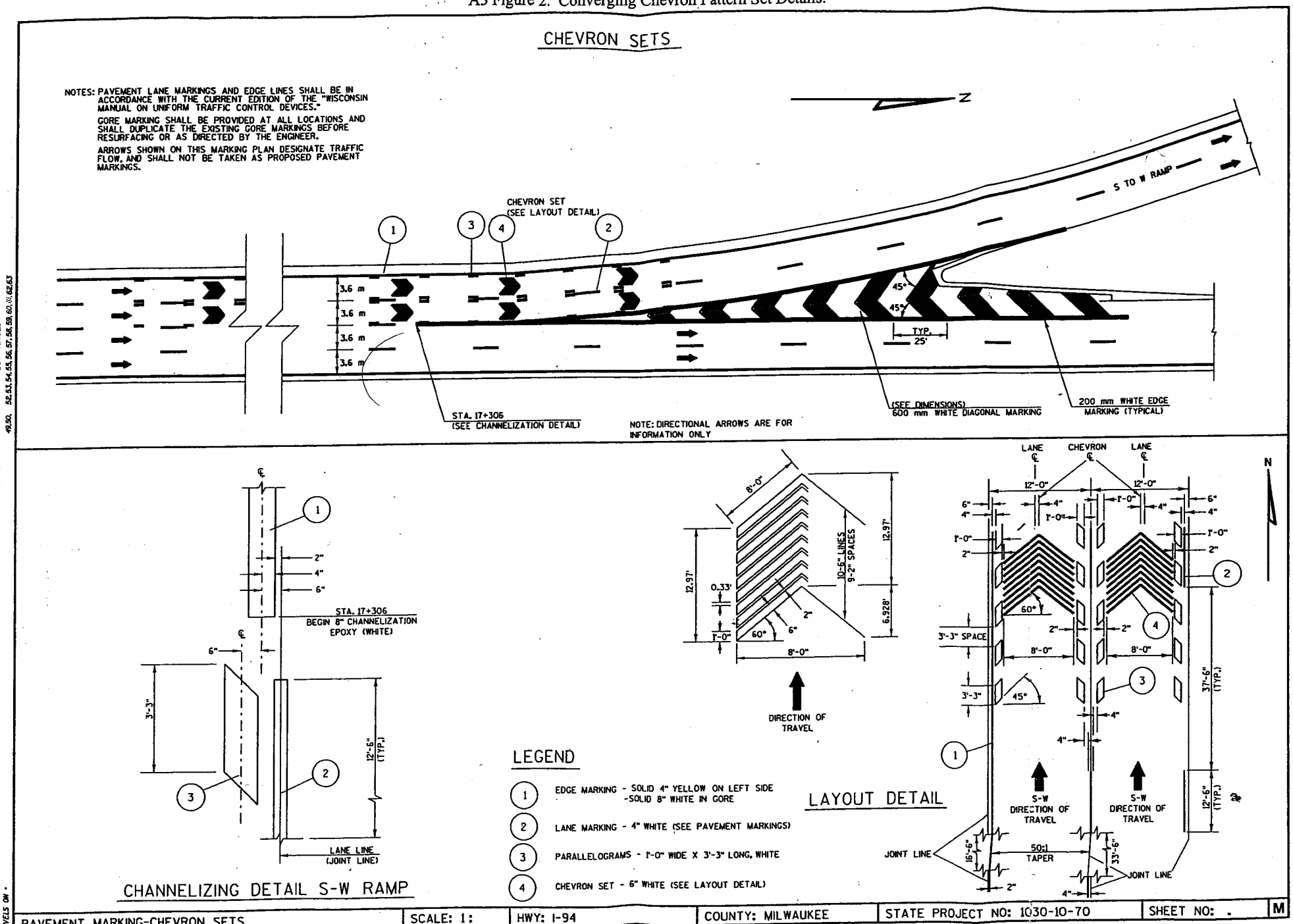
A3 Figure 1. Converging Chevron Pattern Layout.



SET NO.	DISTANCE(FT)	Δ (FT)	STATION (METRIC)
1	-618	42	17+190.98
2	-576	42	17+203.78
3	-534	42	17+216.59
4	-492	42	17+229.40
5	-450	40	17+242.20
6	-410	40	17+254.39
7	-370	40	17+266.58
8	-330	38	17+278.78
9	-292	38	17+290.37
10	-254	38	17+301.96
11	-216	36	17+313.54
12	-180	36	17+324.51
13	-144	36	17+335.49
14	-108	34	17+346.47
15	-74	34	17+356.83
16	-40	0	17+367.20

PAVEMENT MARKING-CHEVRON SETS | SCALE: 1: | HWY: I-94 | COUNTY: MILWAUKEE | STATE PROJECT NO: 1030-10-70 | SHEET NO: . | M

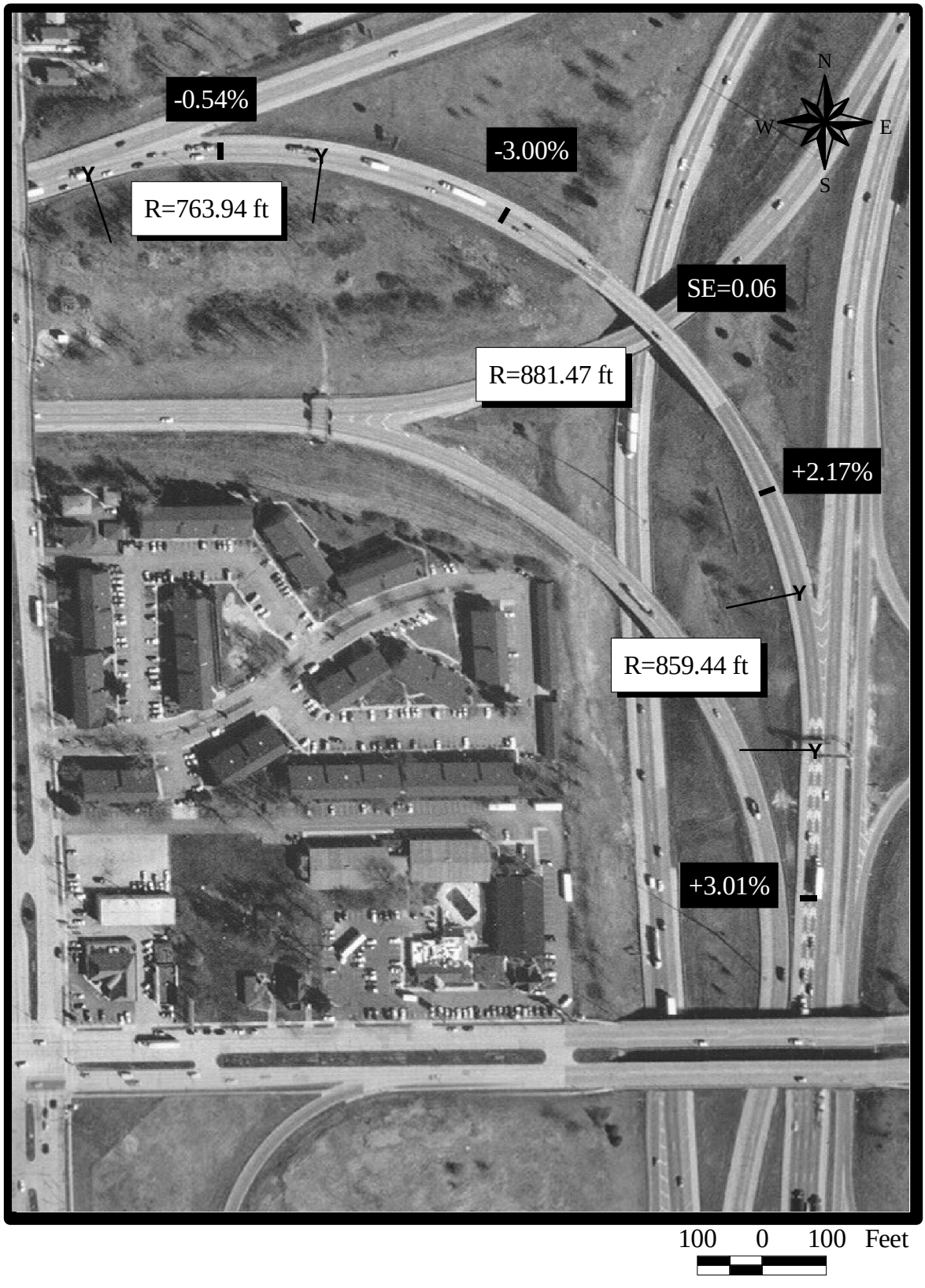
ORIGINATOR: D2 JCT
LEVELS ON - 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63
REV. DATE: 4/20/99
PLOT NAME:
FILE NAME: D2 1030109410CHEVRONS.DG



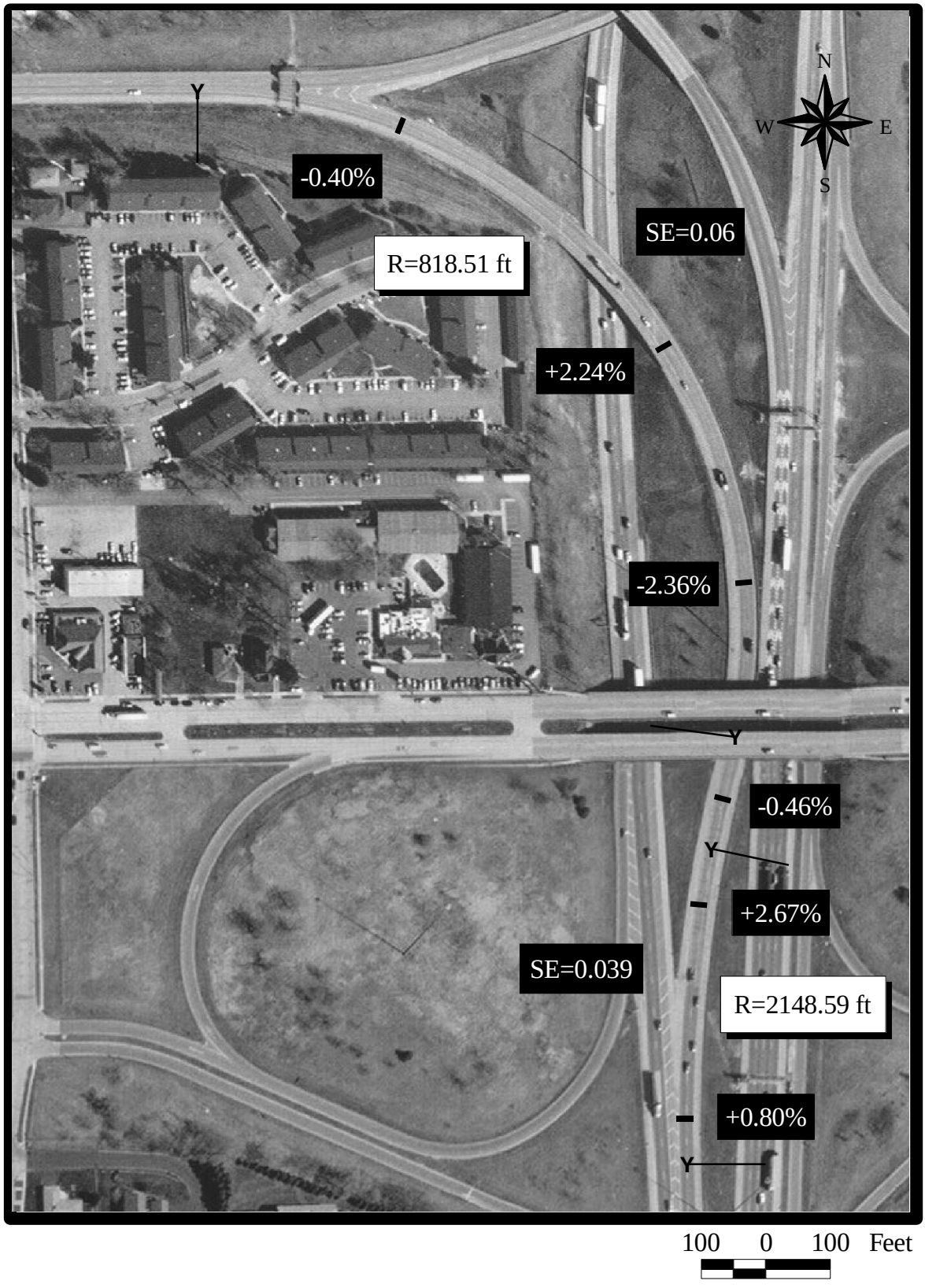
PAVEMENT MARKING-CHEVRON SETS	SCALE: 1:	HWY: I-94	COUNTY: MILWAUKEE	STATE PROJECT NO: 1030-10-70	SHEET NO: .	M

PLOT NAME: 49,50, 52,53,54,55,56,57,58,59,60,61,62,63
REV. DATE: 4/20/99
ORIGINATOR: D2 JCT
LEVELS ON
FILE NAME: D2 10301094\CHEVRONS.DG

A3 Figure 3. Test Ramp Geometry.



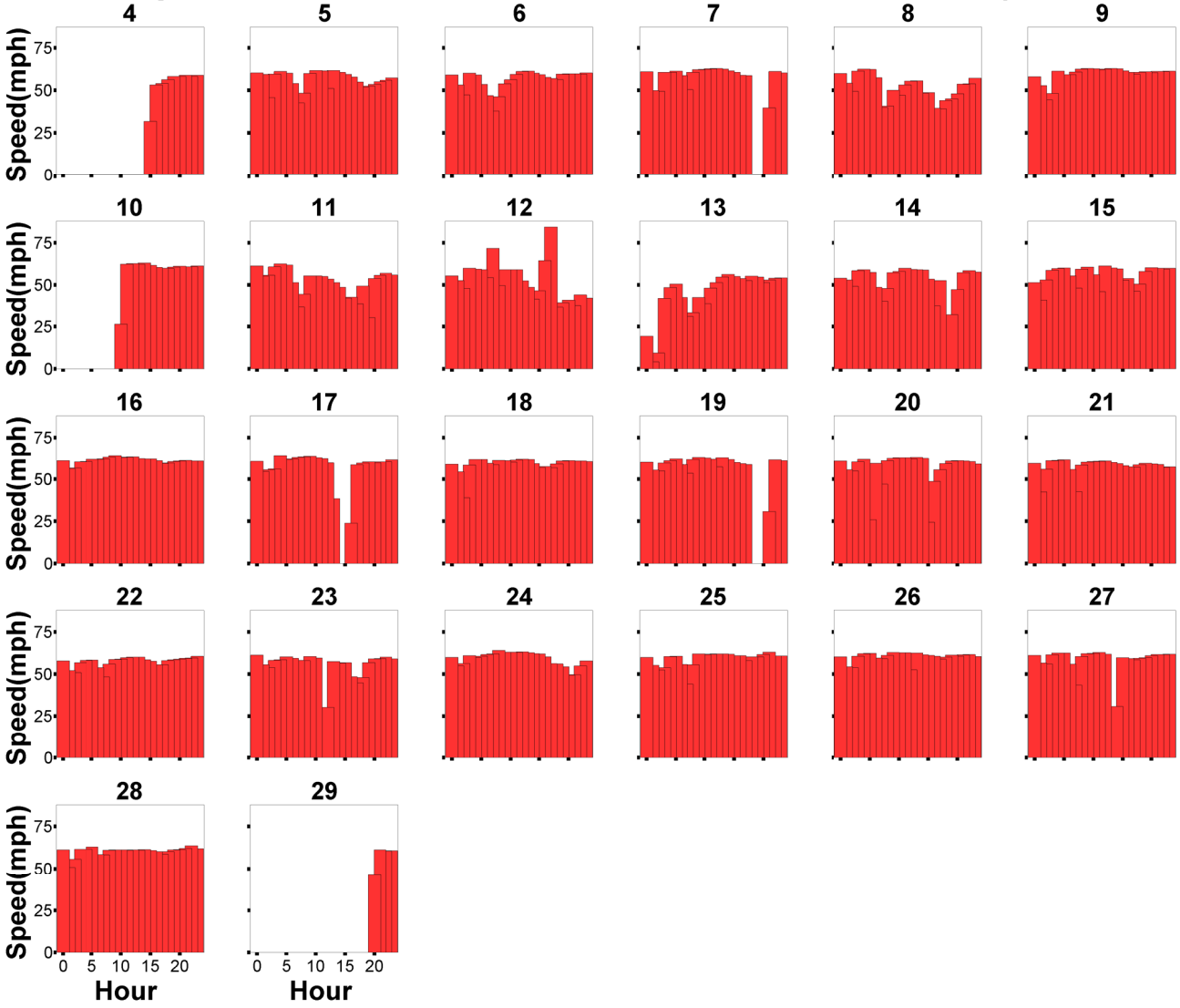
A3 Figure 4. Control Ramp Geometry.



APPENDIX 4
Detector Speeds Before Period

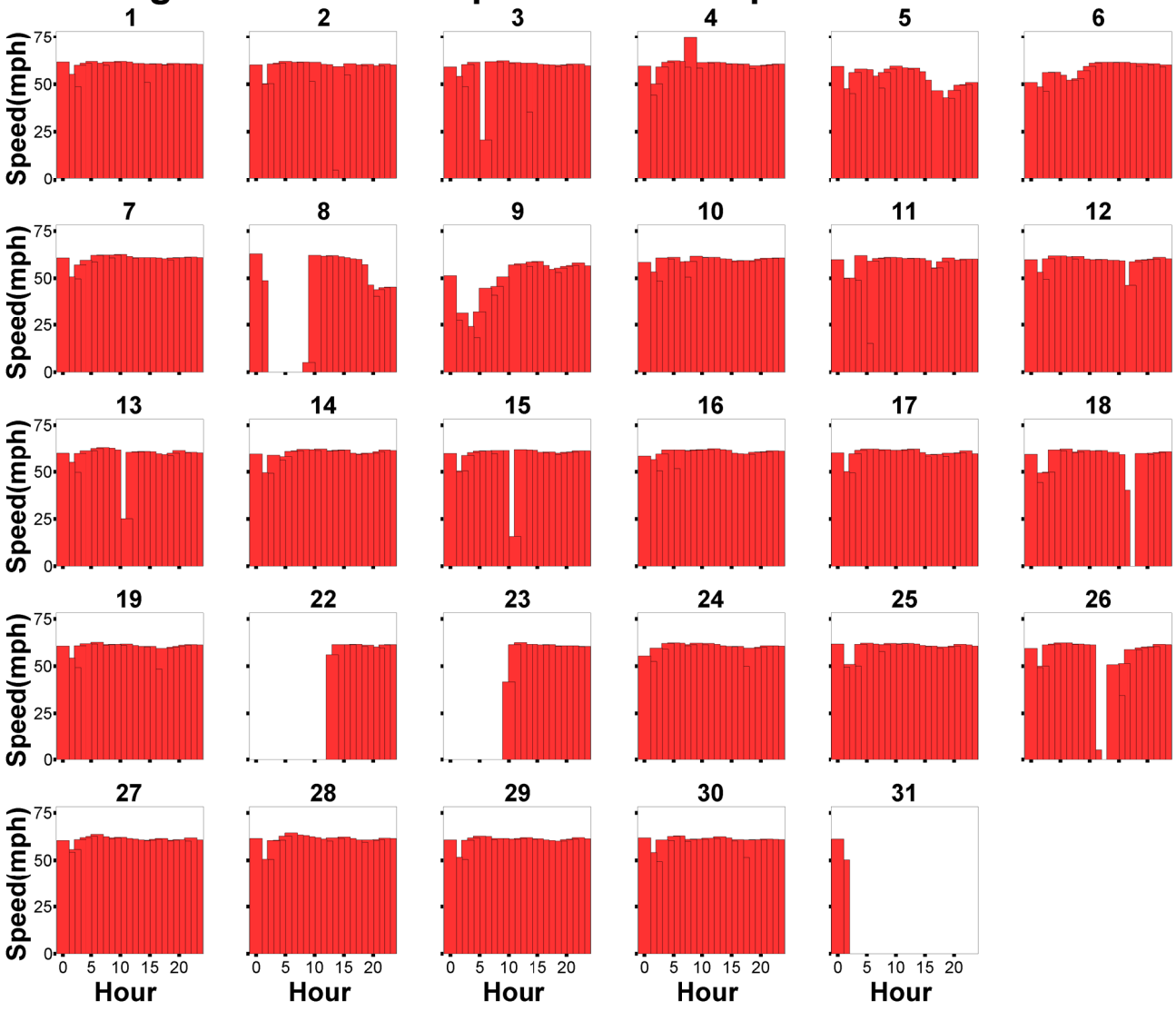
A4 Figure 1. Test Ramp: Detector A Speeds December 1998.

A4 Figure 2. Test Ramp: Detector A Speeds January 1999.



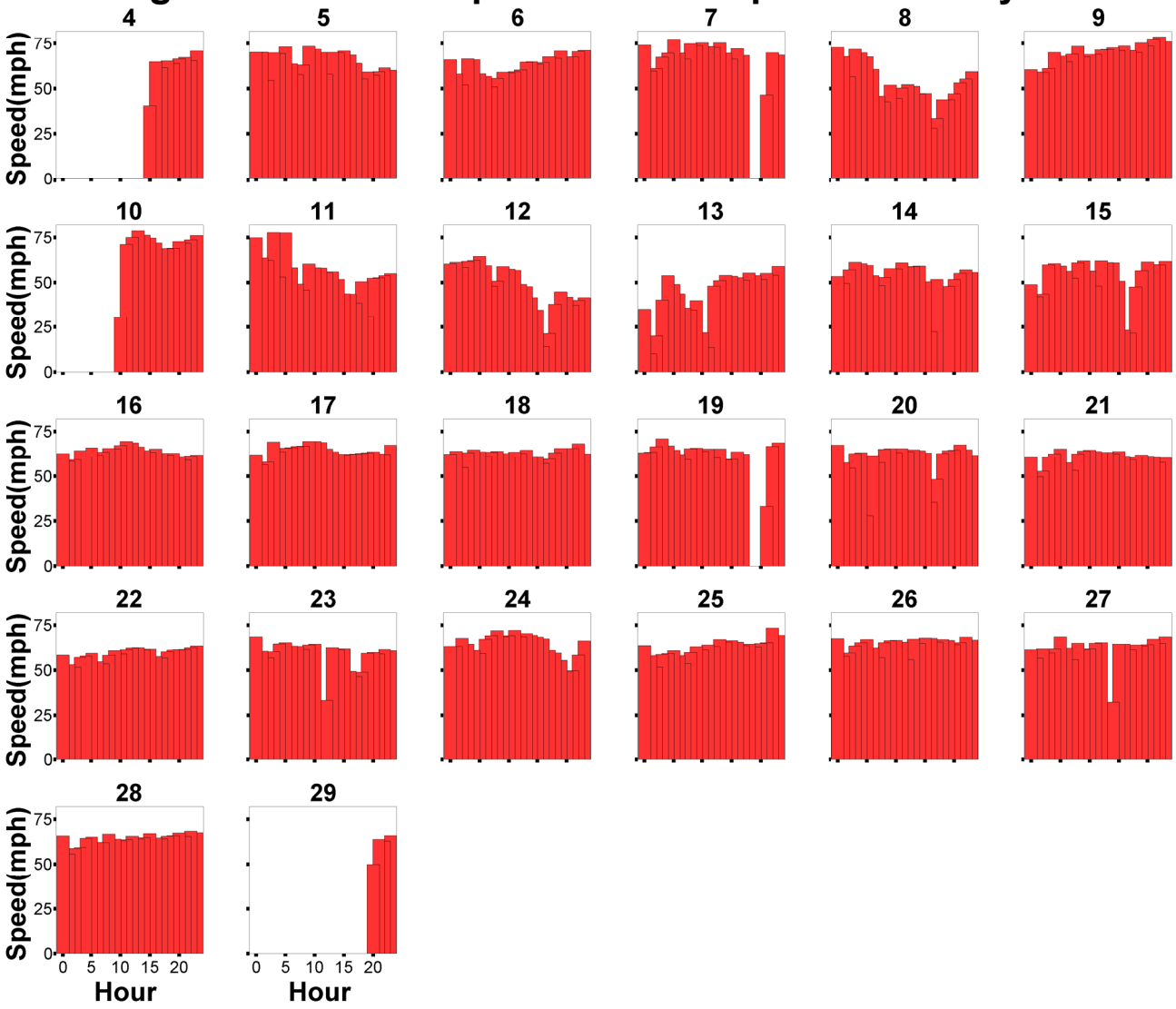
A4 Figure 3. Test Ramp: Detector A Speeds February 1999.

A4 Figure 4. Test Ramp: Detector A Speeds March 1999.



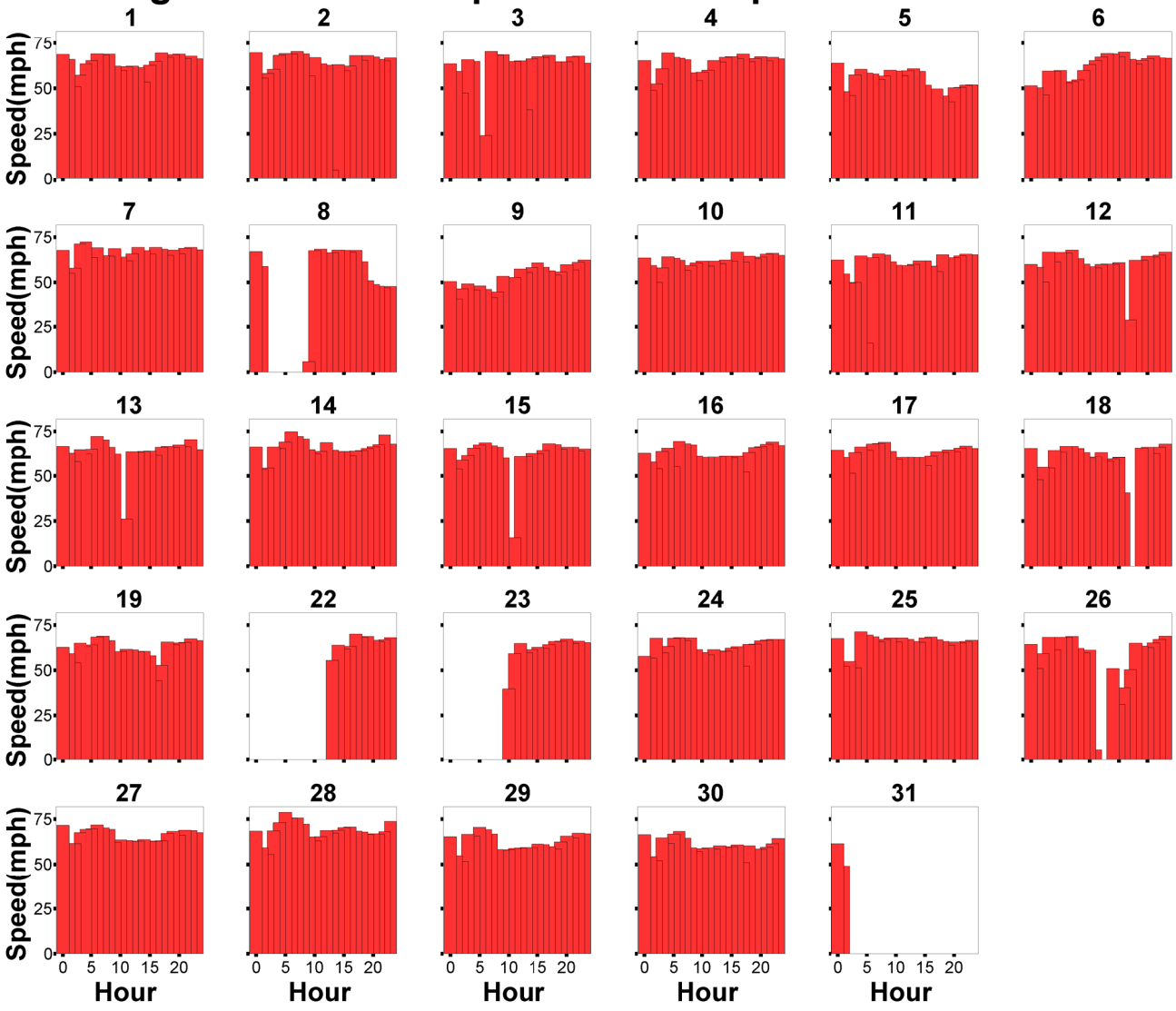
A4 Figure 5. Test Ramp: Detector B Speeds December 1998.

A4 Figure 6. Test Ramp: Detector B Speeds January 1999.



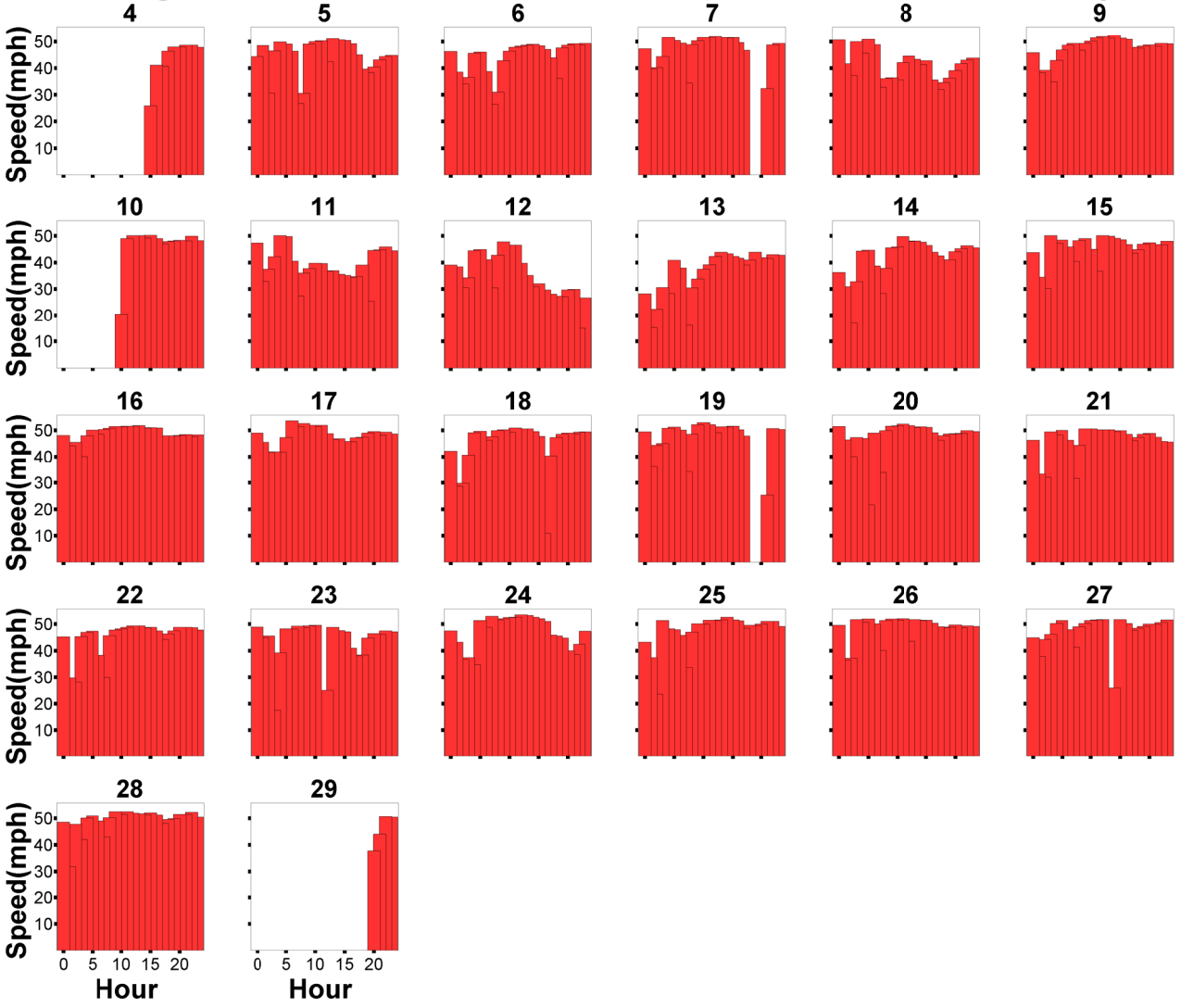
A4 Figure 7. Test Ramp: Detector B Speeds February 1999.

A4 Figure 8. Test Ramp: Detector B Speeds March 1999.



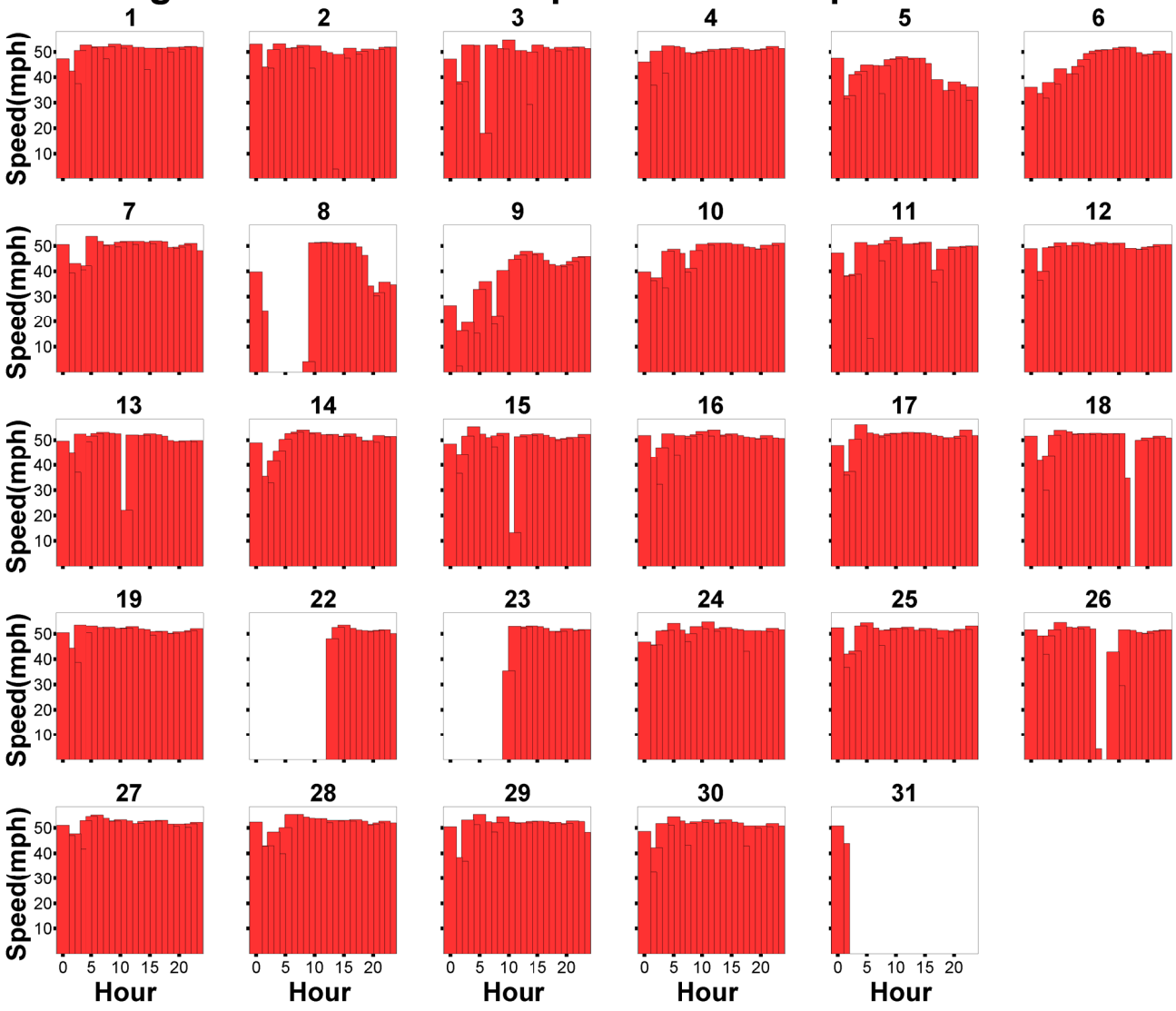
A4 Figure 9. Control Ramp: Detector C Speeds December 1998.

A4 Figure 10. Control Ramp: Detector C Speeds January 1999.



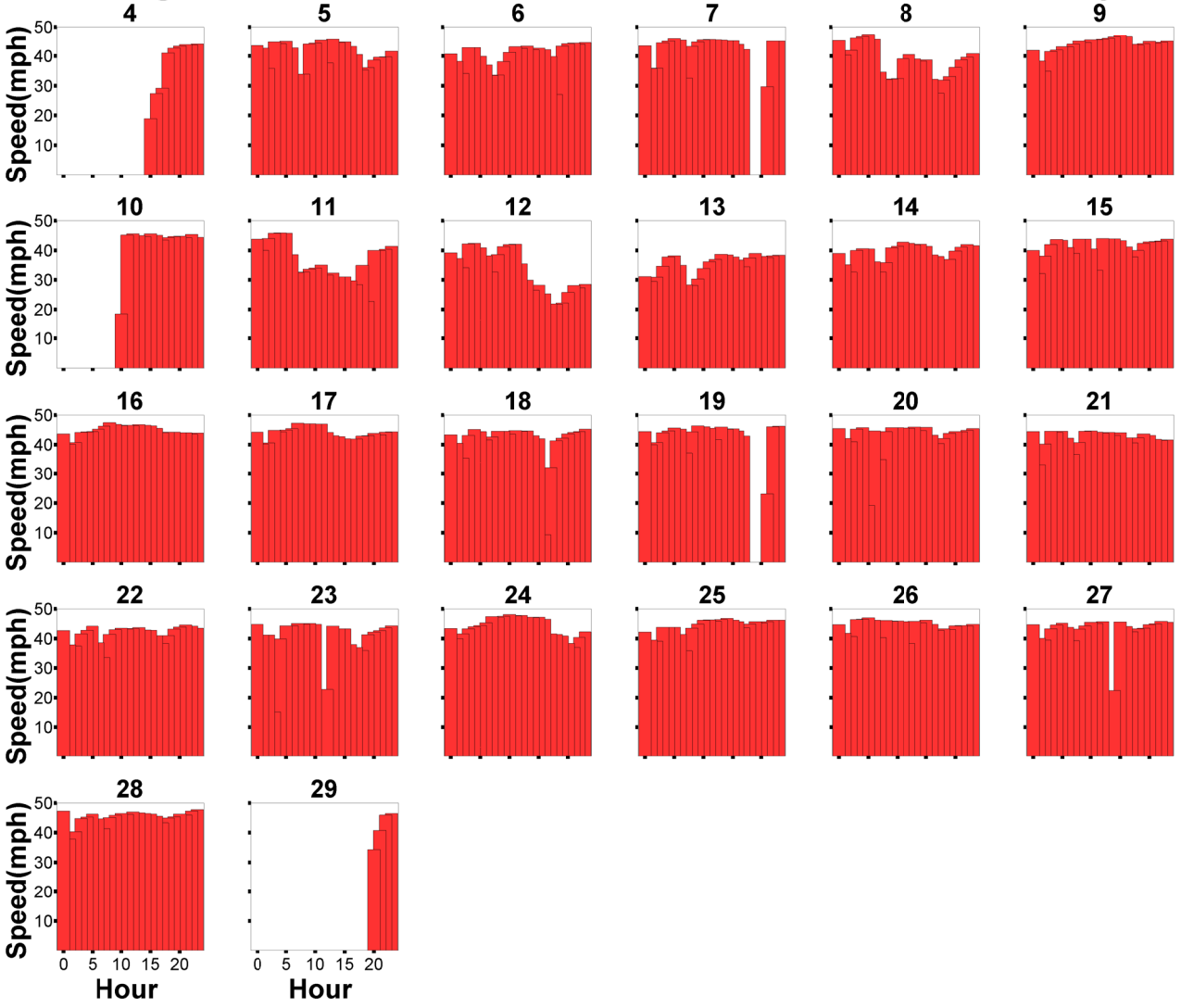
A4 Figure 11. Control Ramp: Detector C Speeds February 1999.

A4 Figure 12. Control Ramp: Detector C Speeds March 1999.

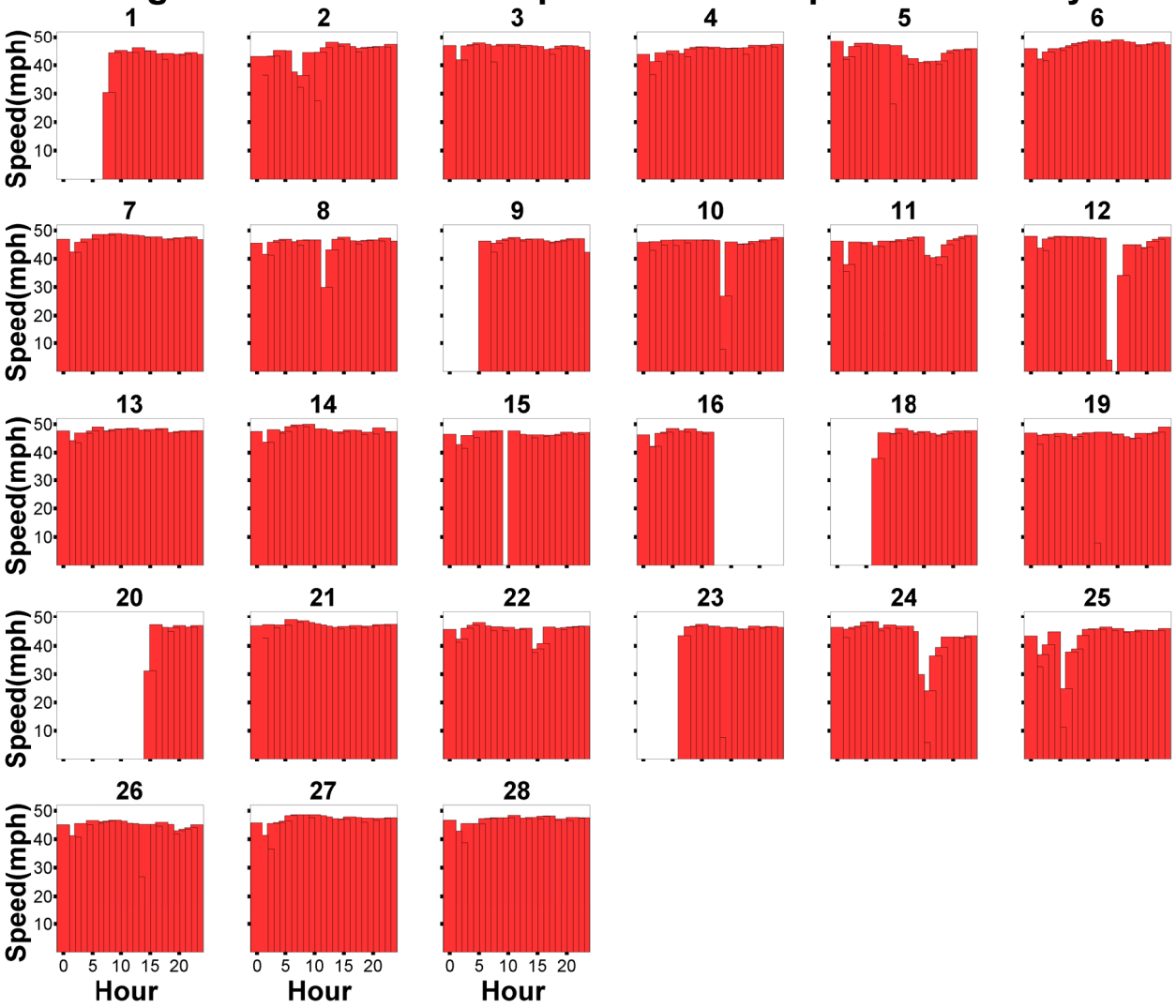


A4 Figure 13. Control Ramp: Detector D Speeds December 1998.

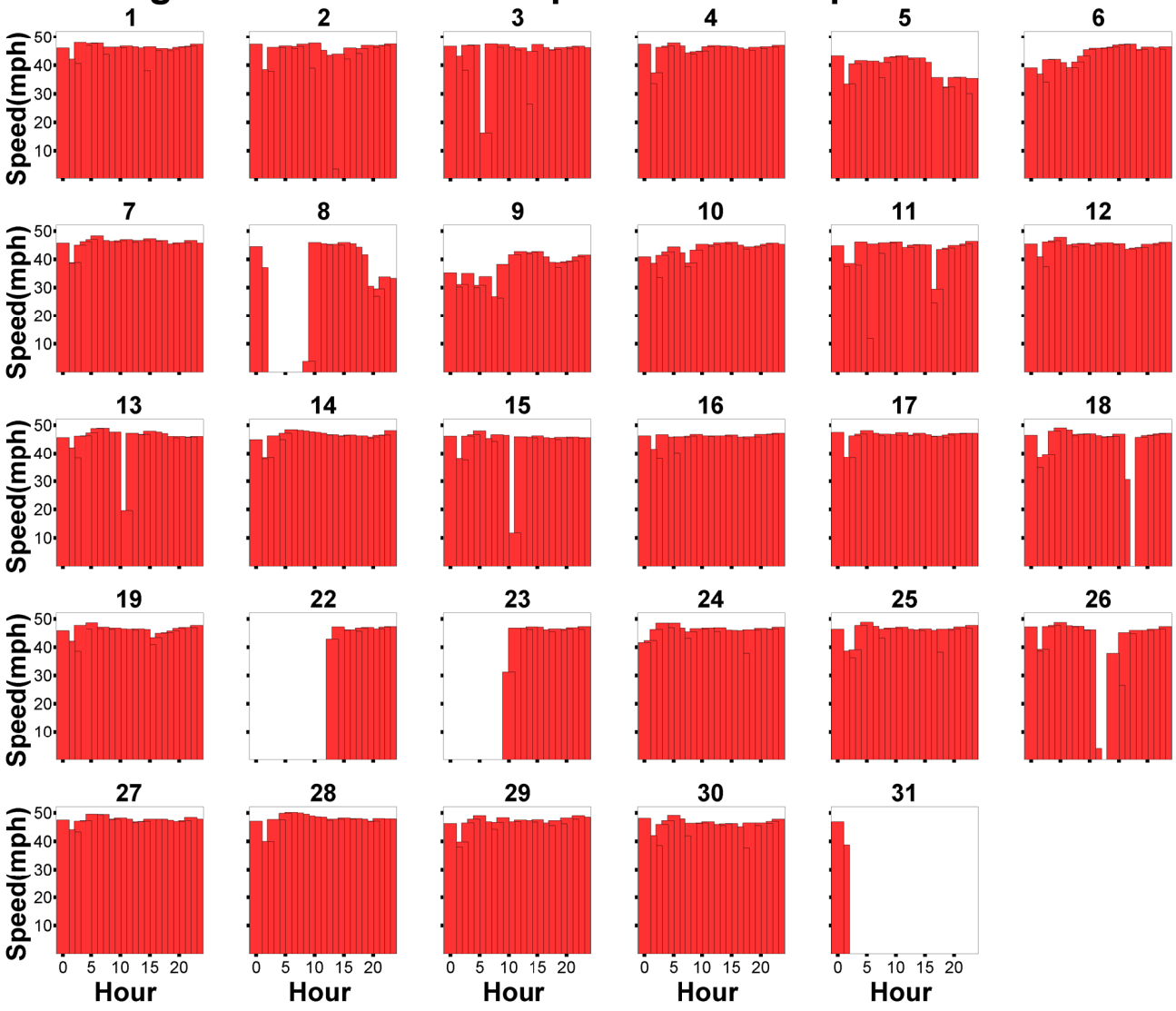
A4 Figure 14. Control Ramp: Detector D Speeds January 1999.



A4 Figure 15. Control Ramp: Detector D Speeds February 1999.

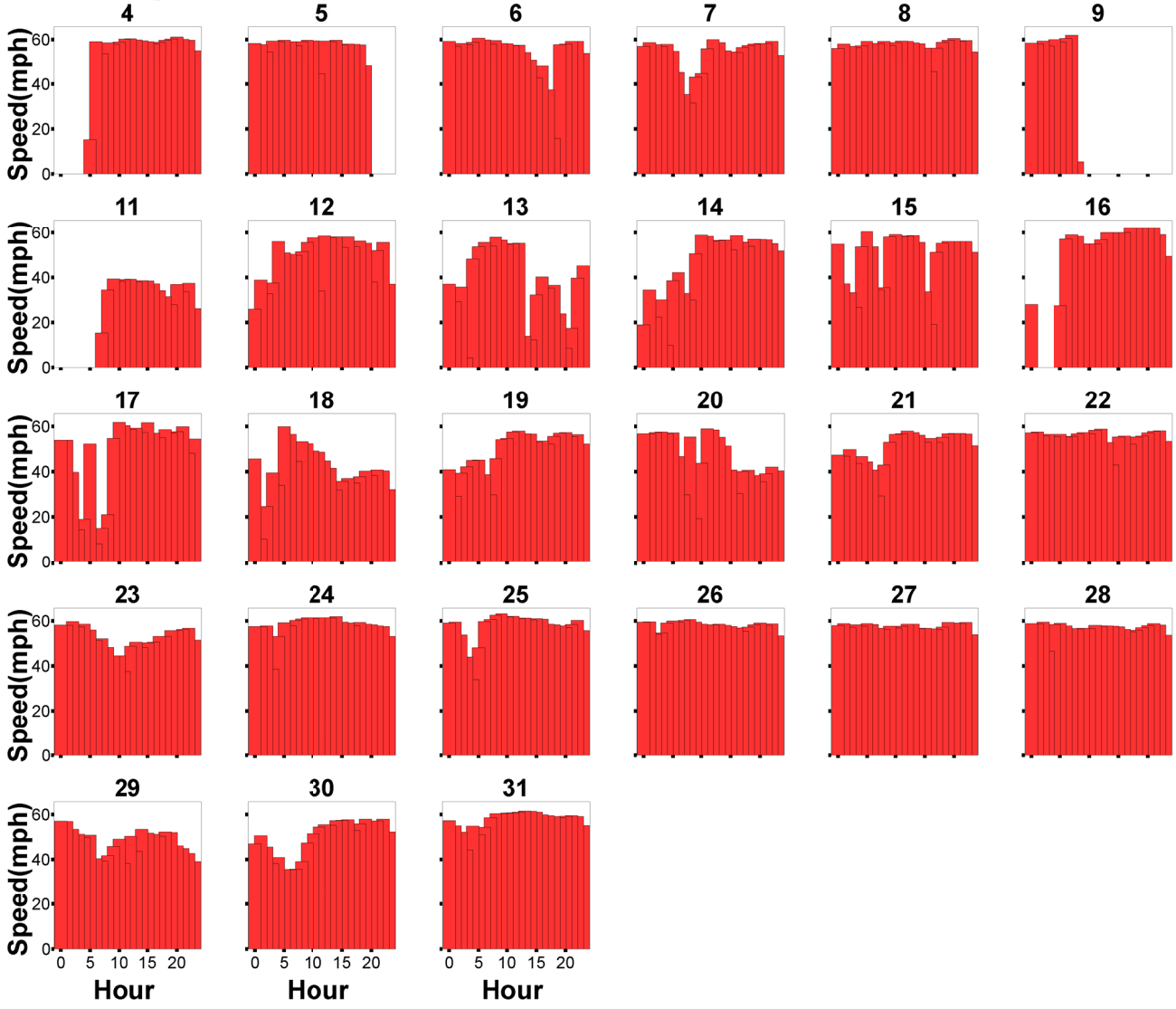


A4 Figure 16. Control Ramp: Detector D Speeds March 1999.

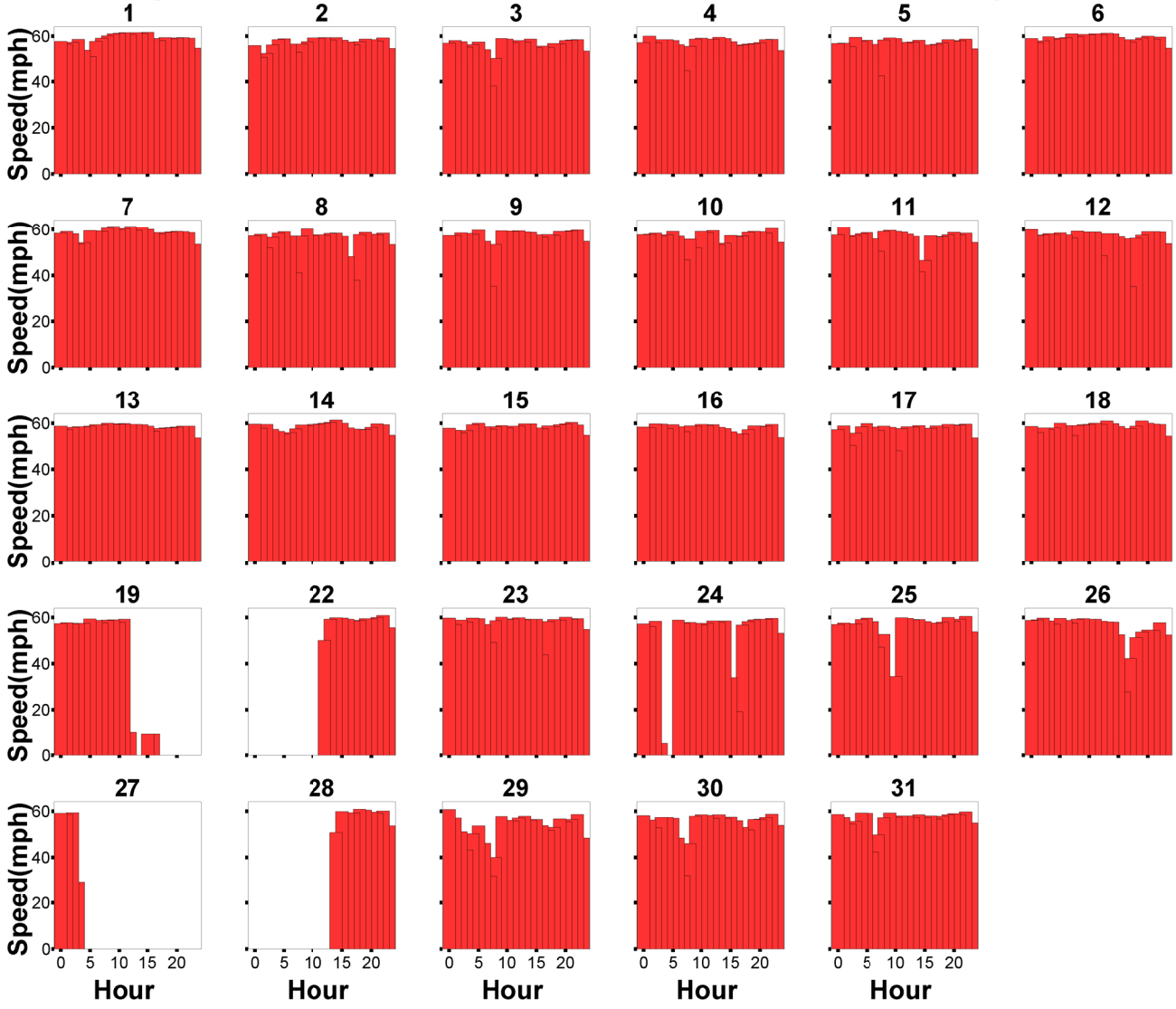


APPENDIX 5
Detector Speeds After Period

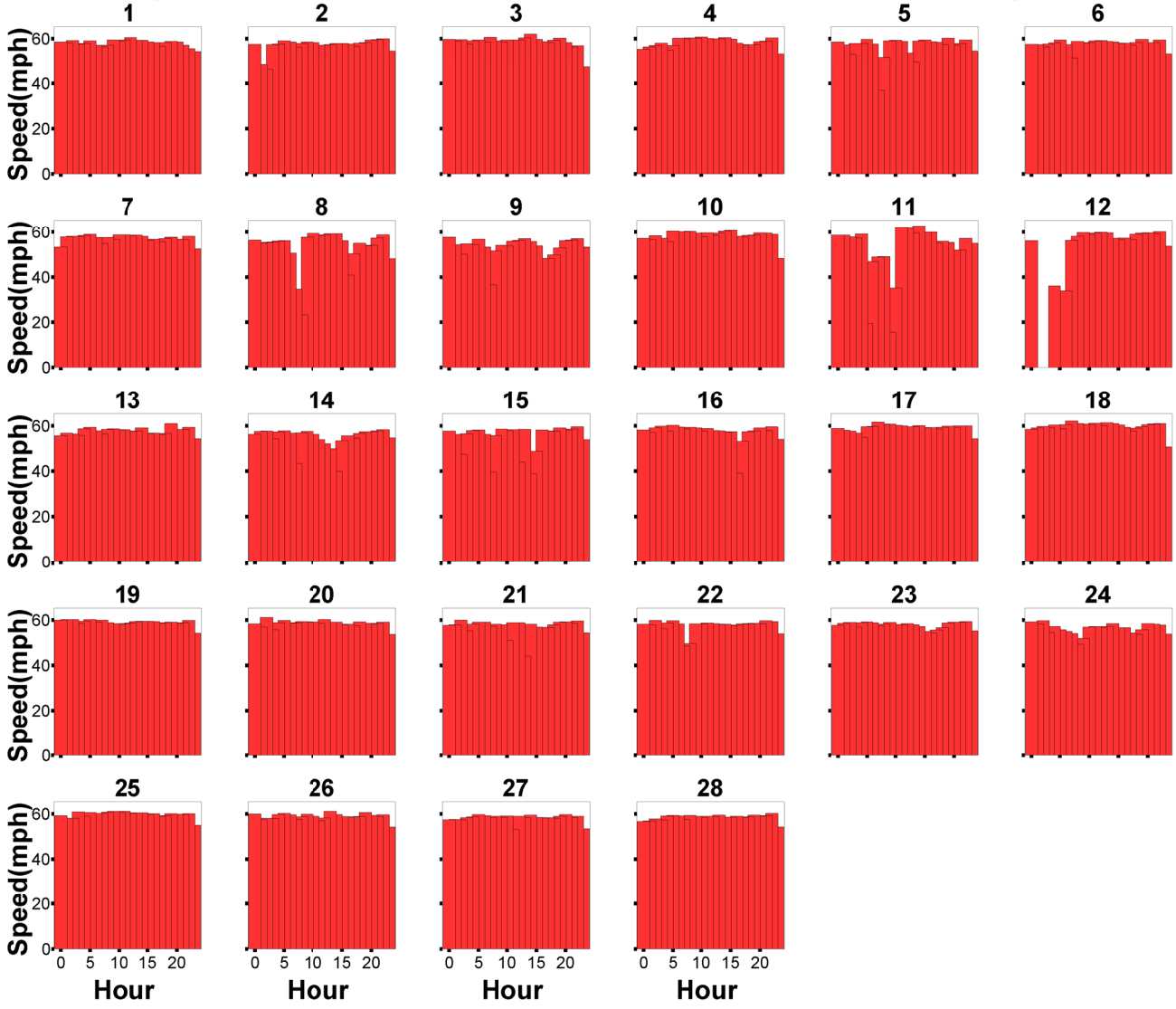
A5 Figure 1. Test Ramp: Detector A Speeds December 2000.



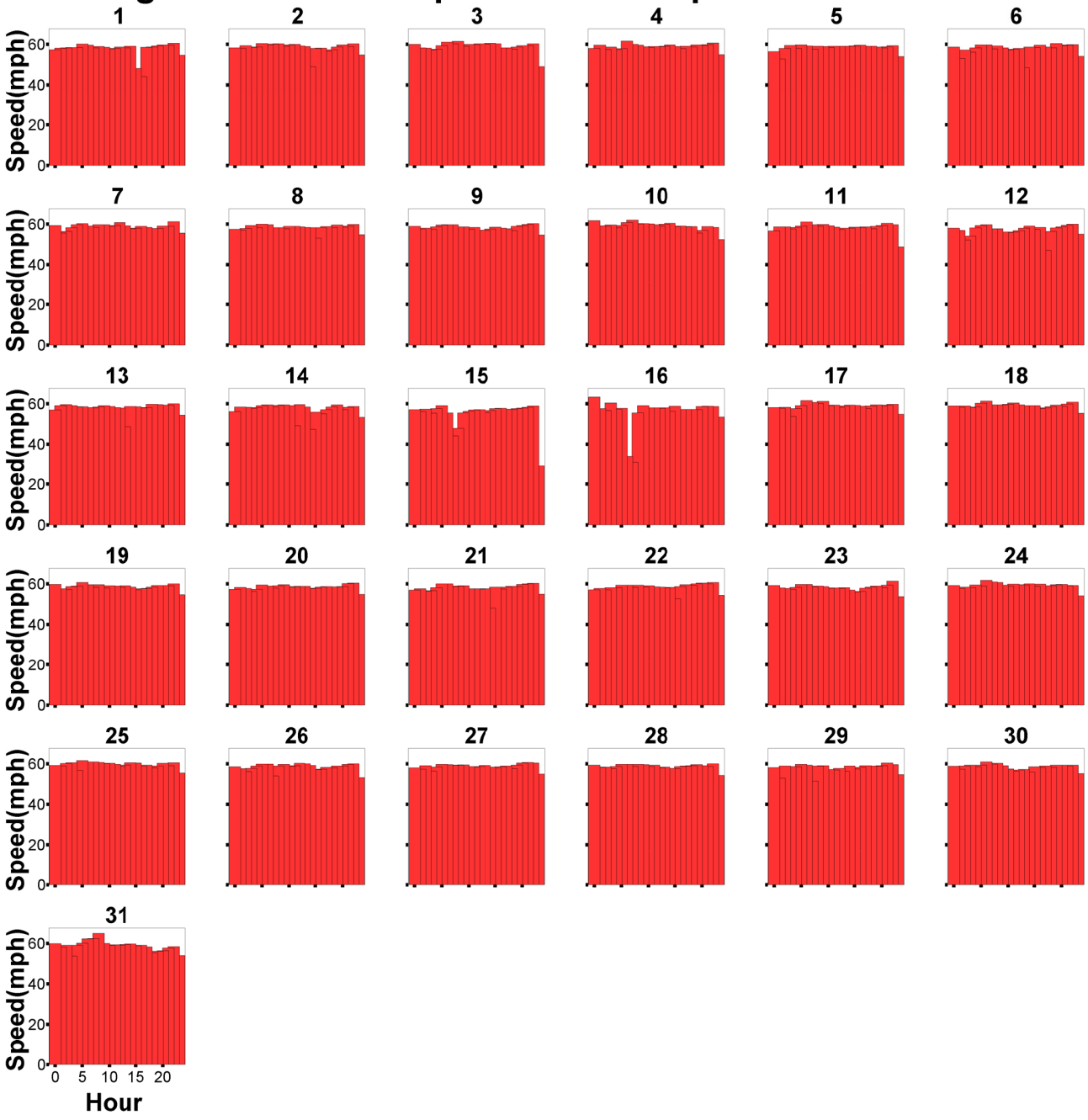
A5 Figure 2. Test Ramp: Detector A Speeds January 2001.



A5 Figure 3. Test Ramp: Detector A Speeds February 2001.

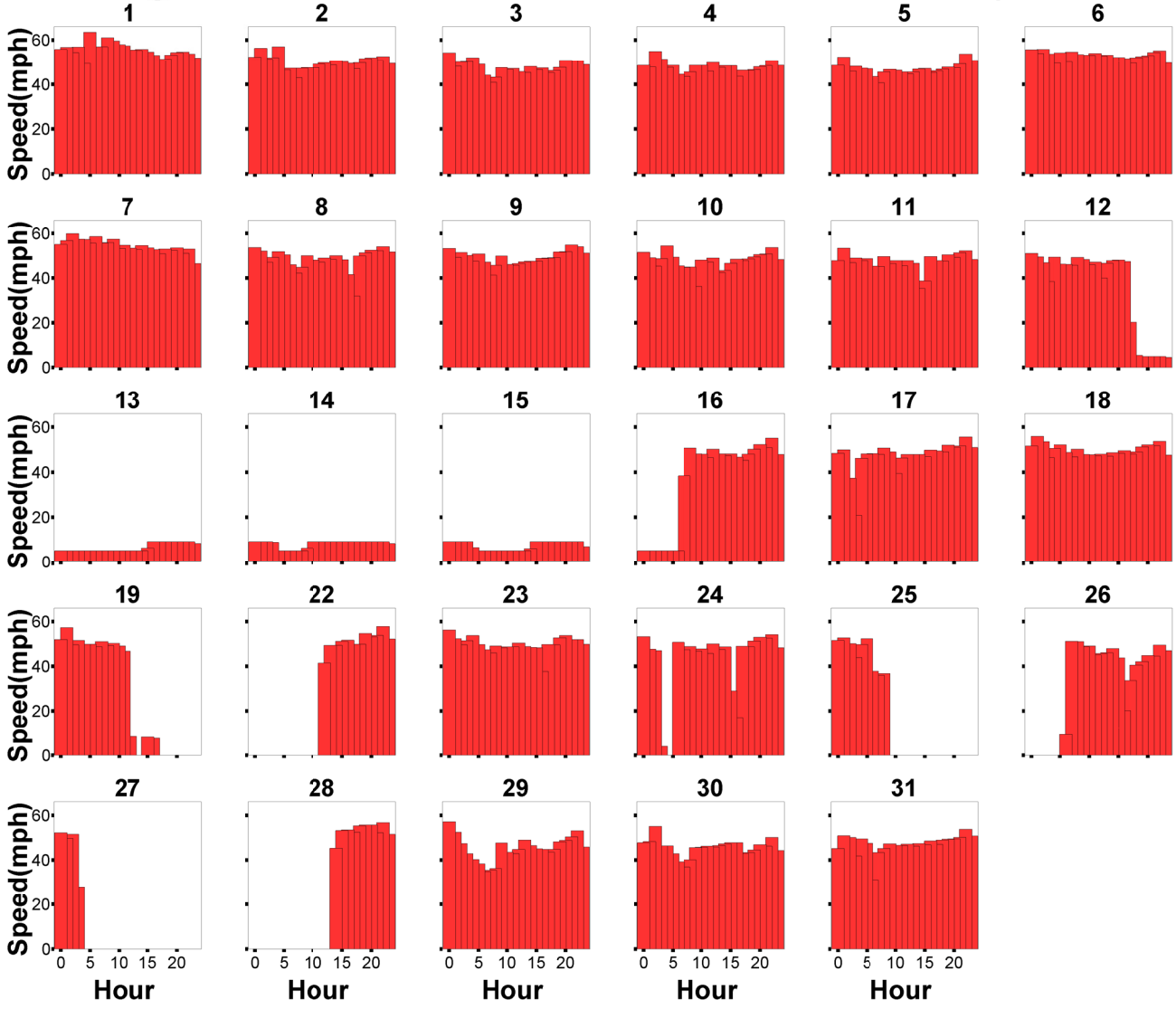


A5 Figure 4. Test Ramp: Detector A Speeds March 2001.

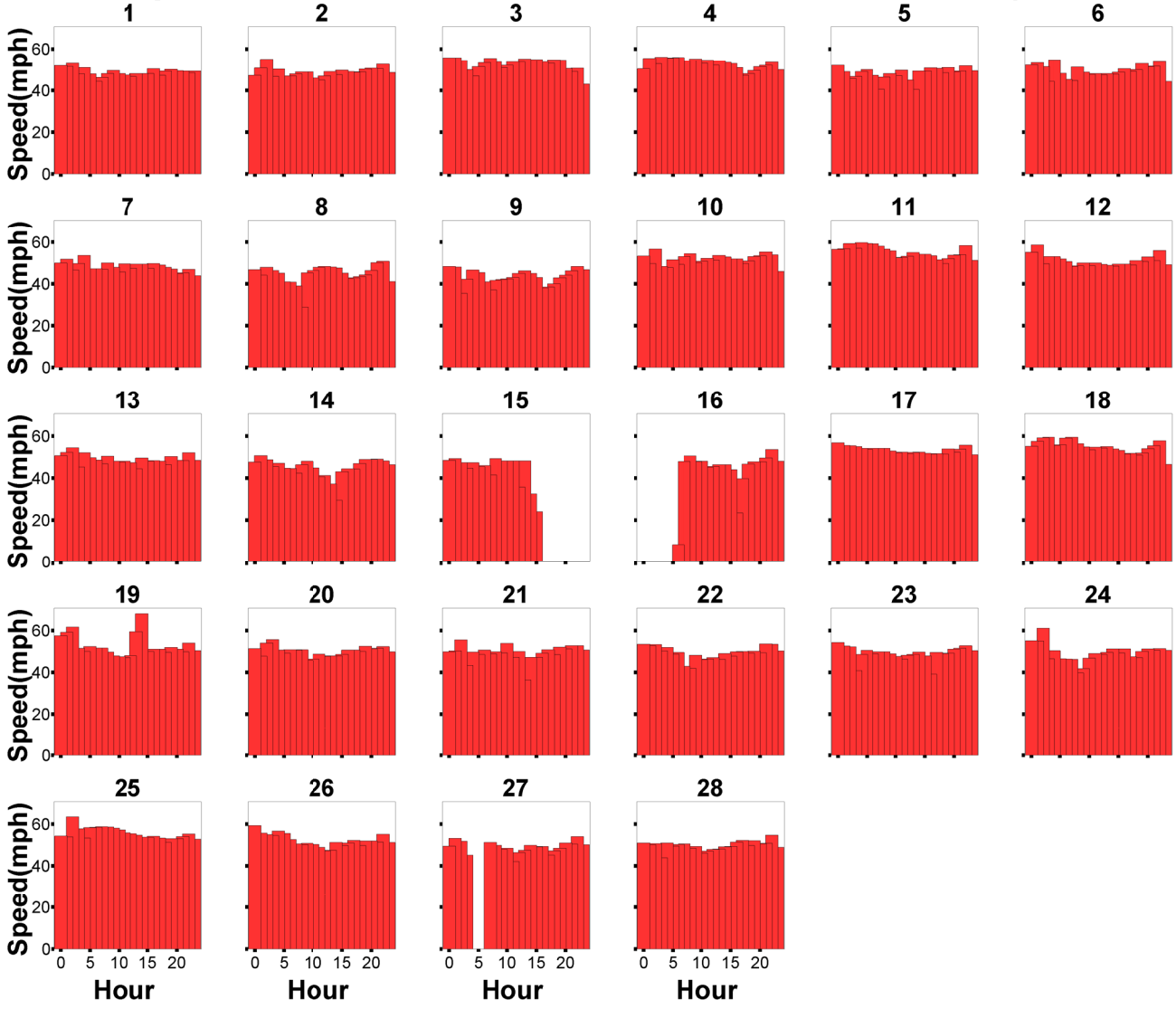


A5 Figure 5. Test Ramp: Detector B Speeds December 2000.

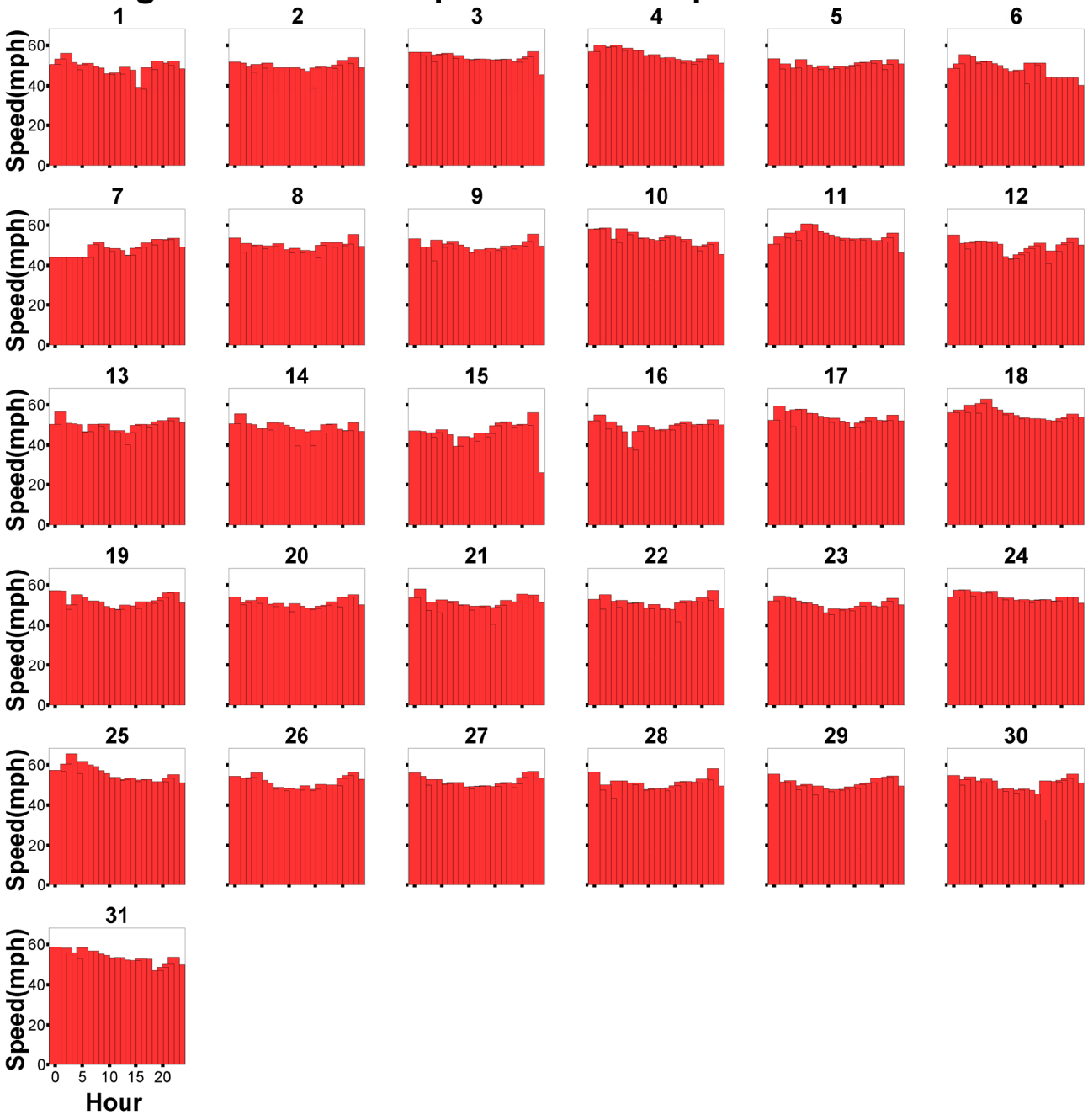
A5 Figure 6. Test Ramp: Detector B Speeds January 2001.



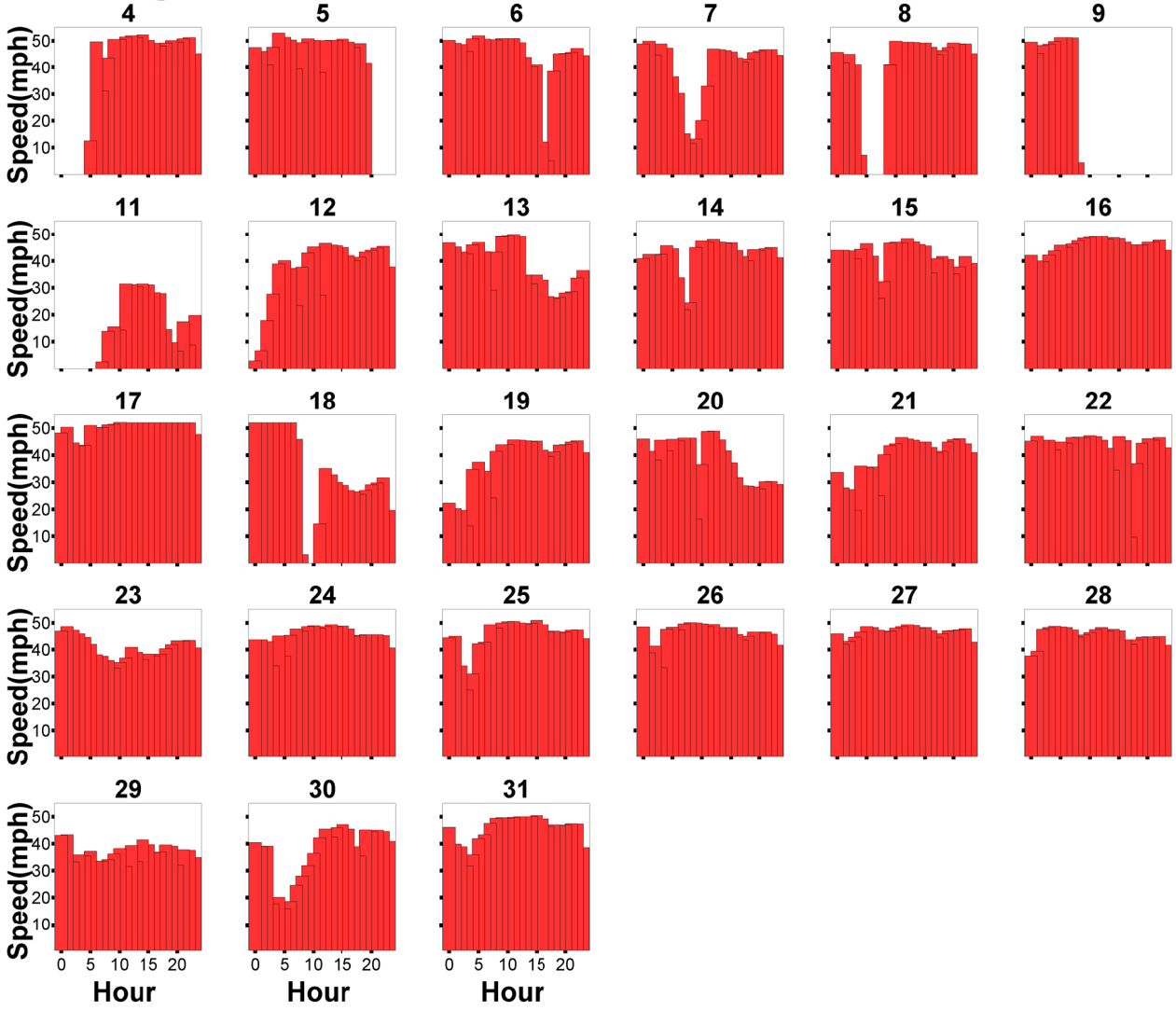
A5 Figure 7. Test Ramp: Detector B Speeds February 2001.



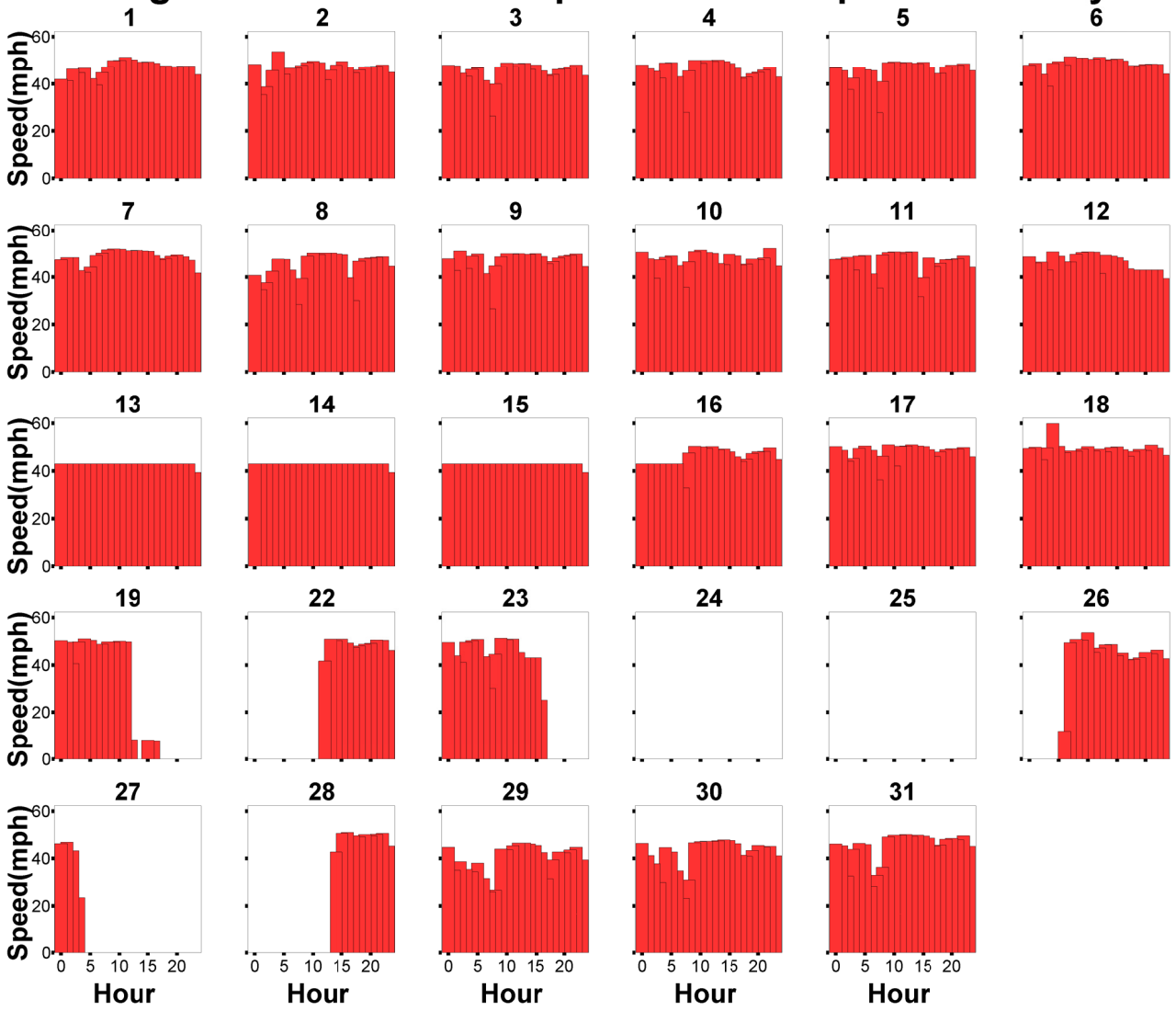
A5 Figure 8. Test Ramp: Detector B Speeds March 2001.



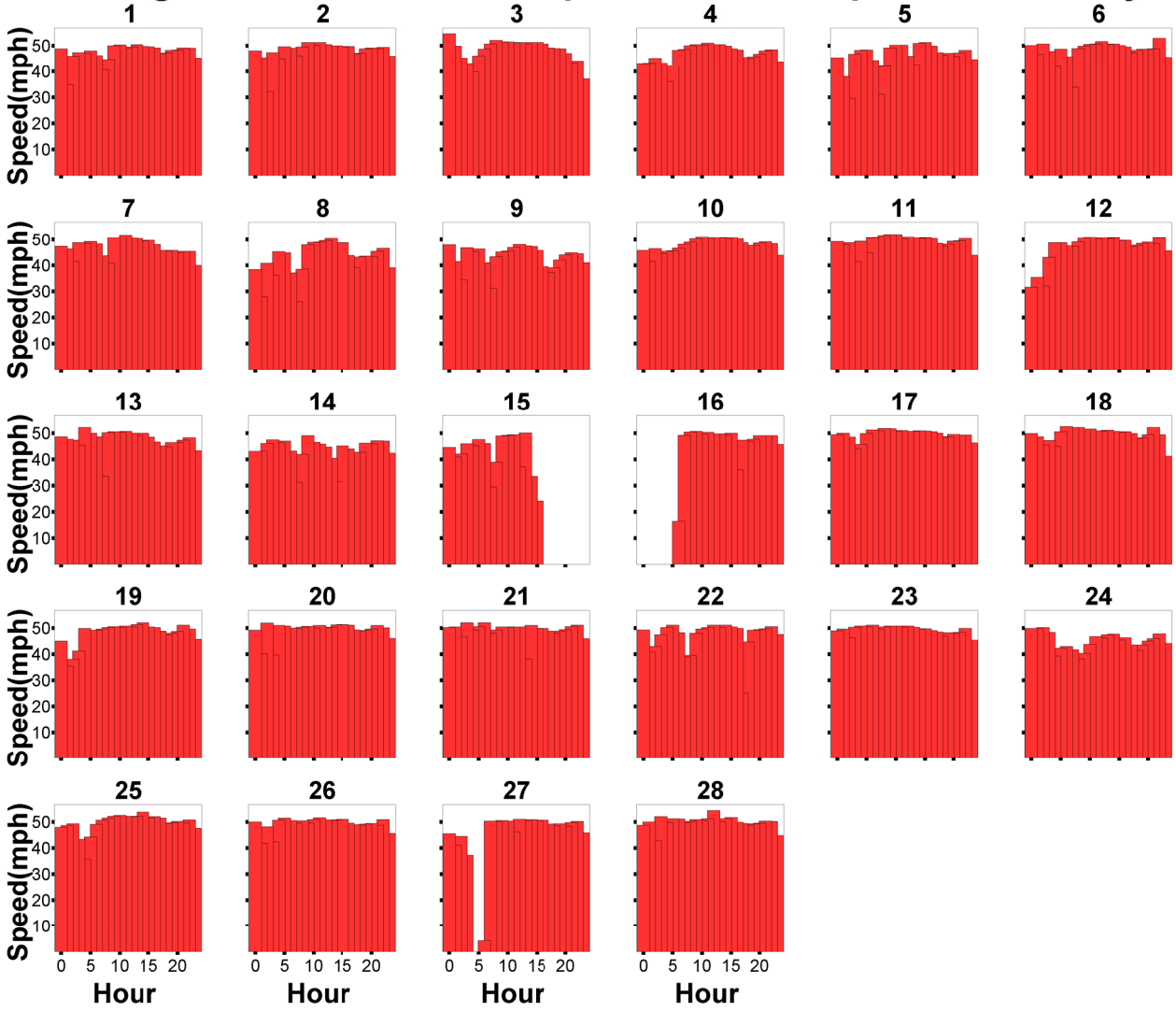
A5 Figure 9. Control Ramp: Detector C Speeds December 2000.



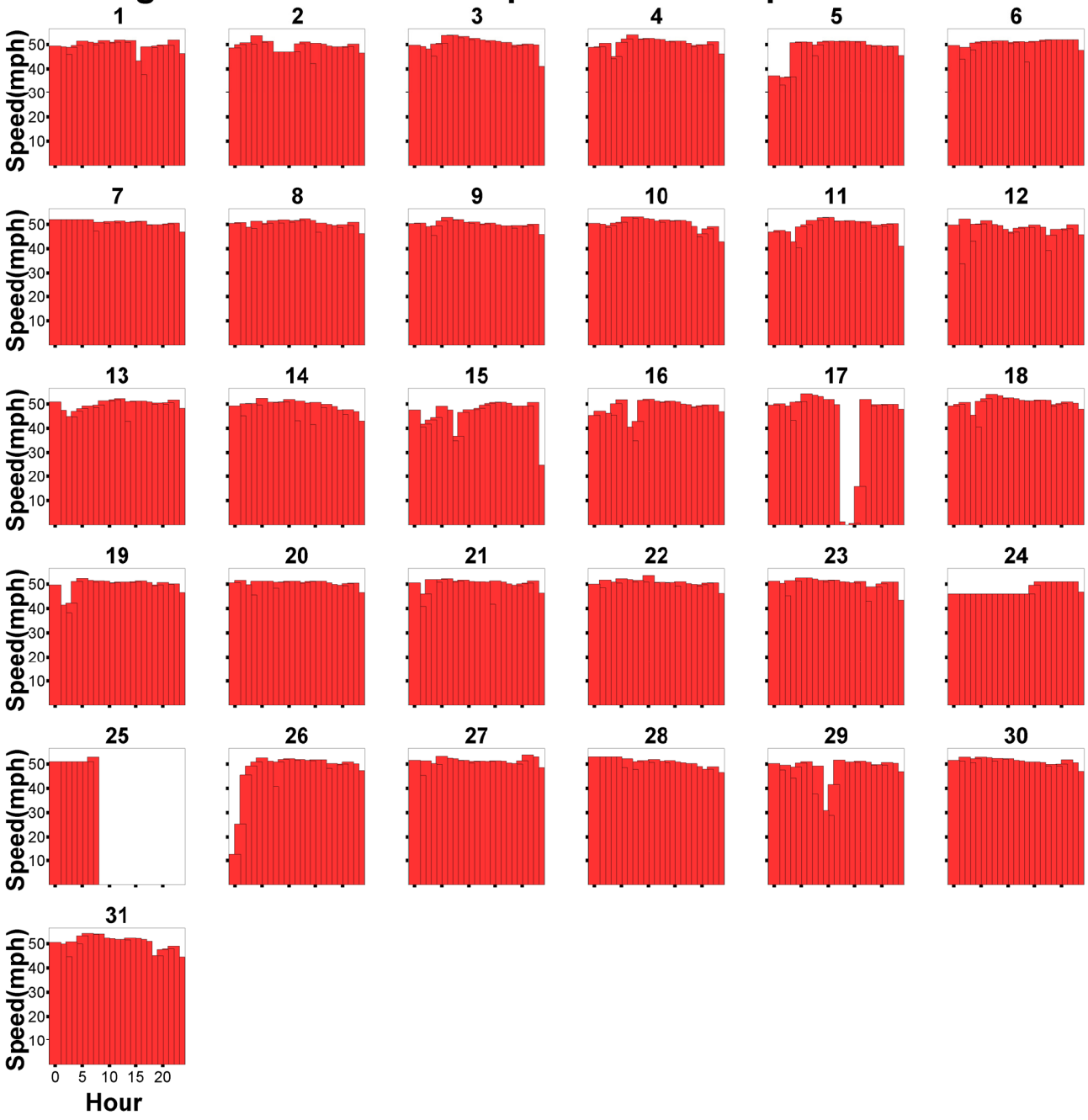
A5 Figure 10. Control Ramp: Detector C Speeds January 2001.



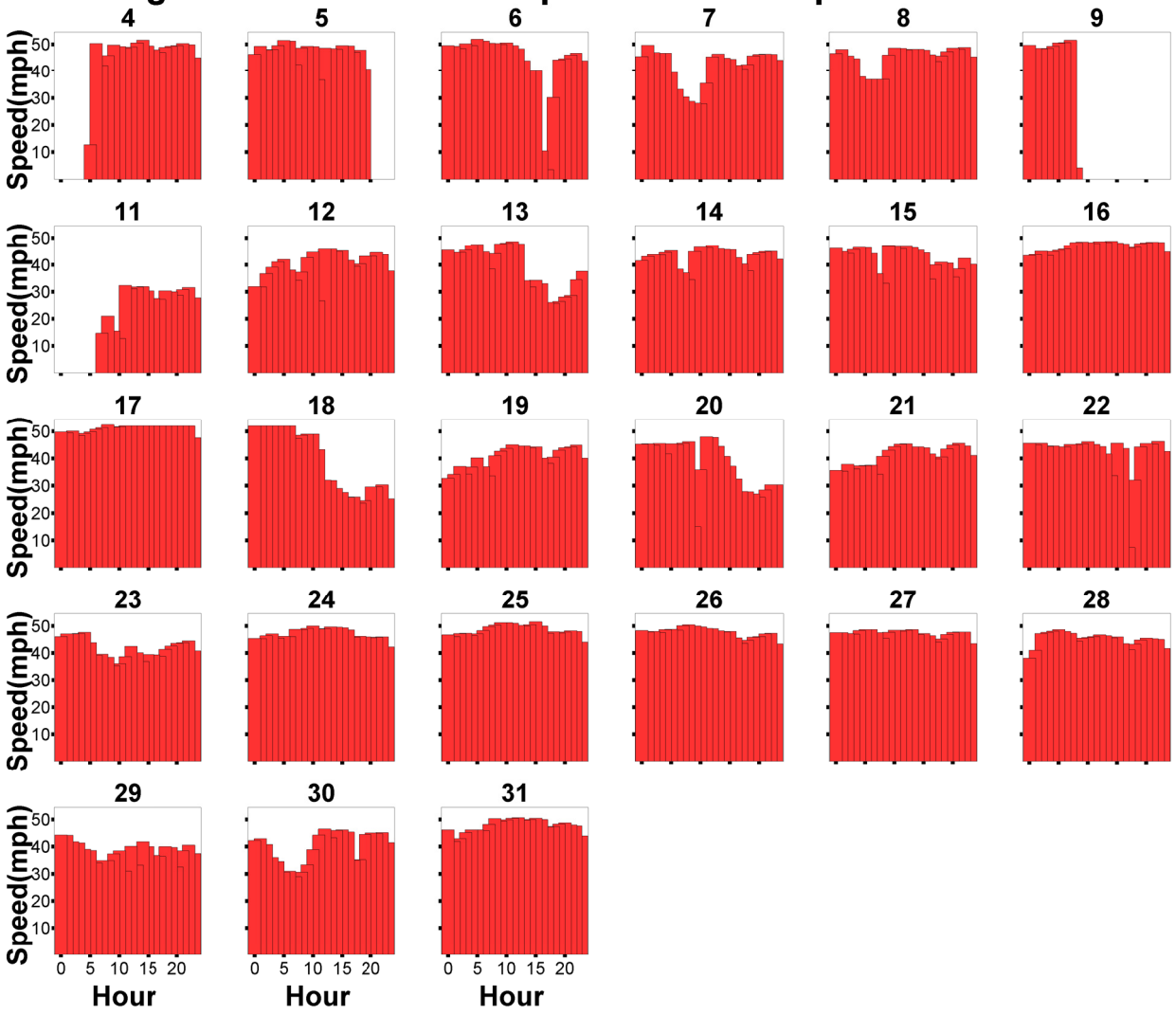
A5 Figure 11. Control Ramp: Detector C Speeds February 2001.



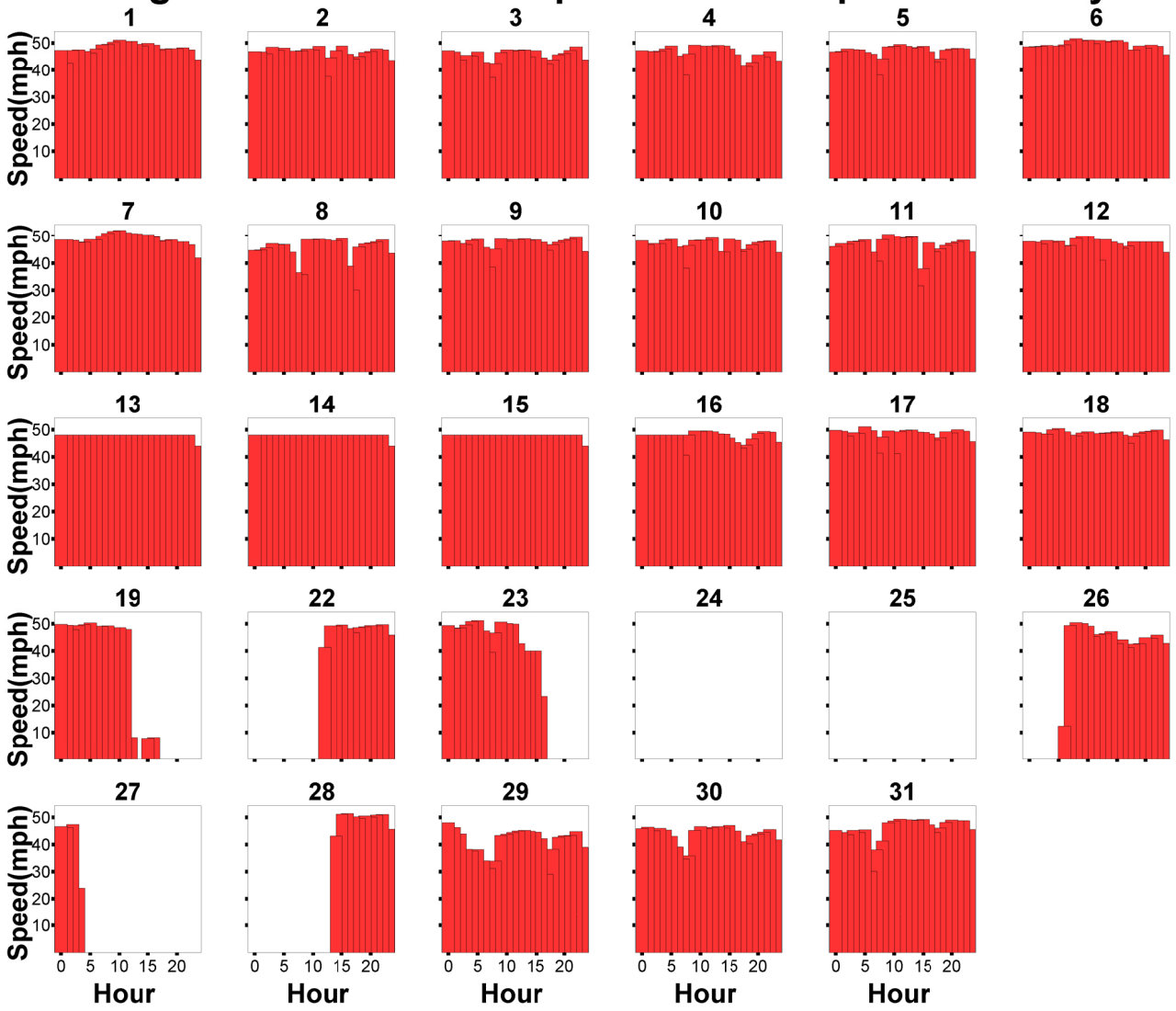
A5 Figure 12. Control Ramp: Detector C Speeds March 2001.



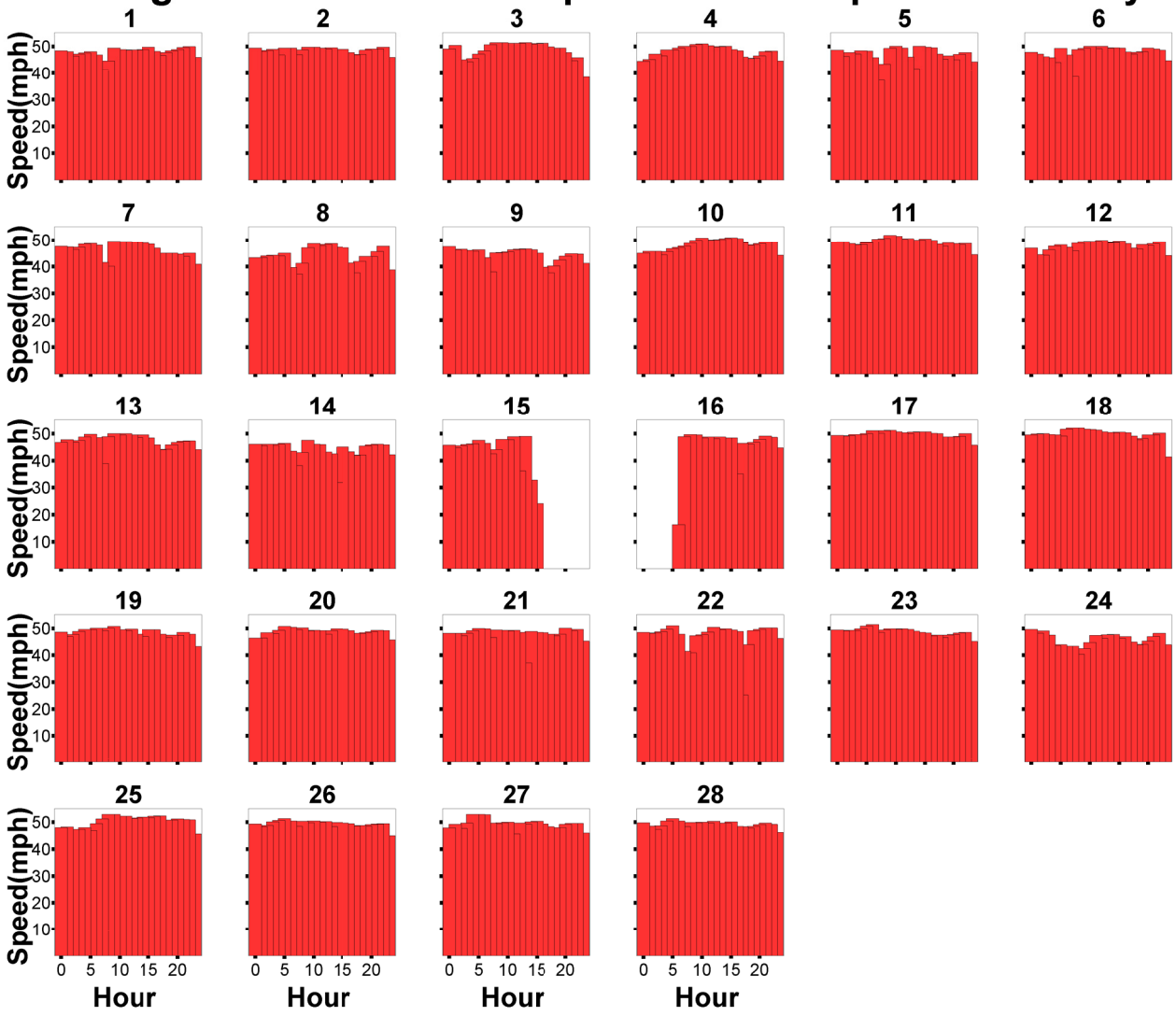
A5 Figure 13. Control Ramp: Detector D Speeds December 2000.



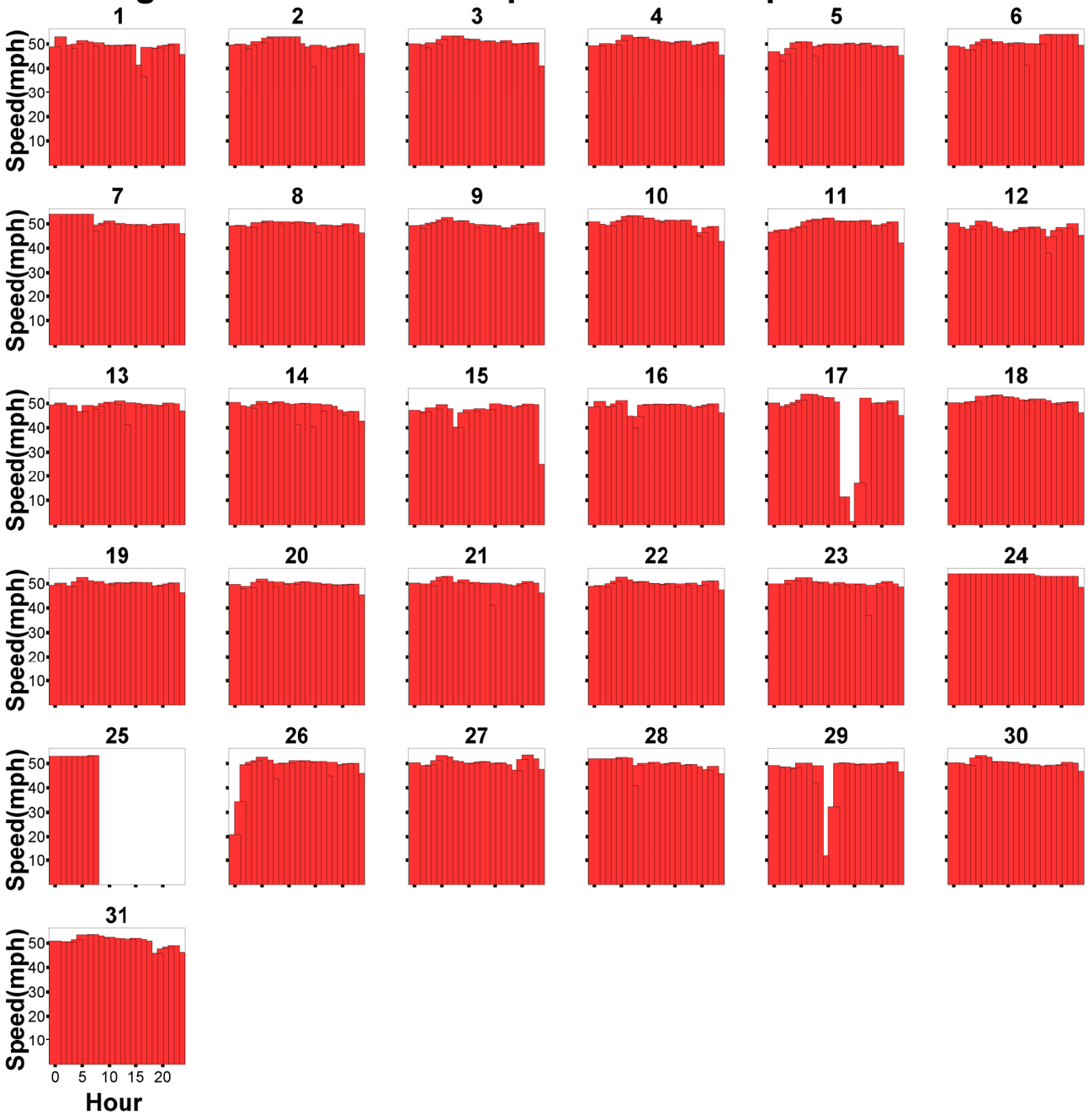
A5 Figure 14. Control Ramp: Detector D Speeds January 2001.



A5 Figure 15. Control Ramp: Detector D Speeds February 2001.

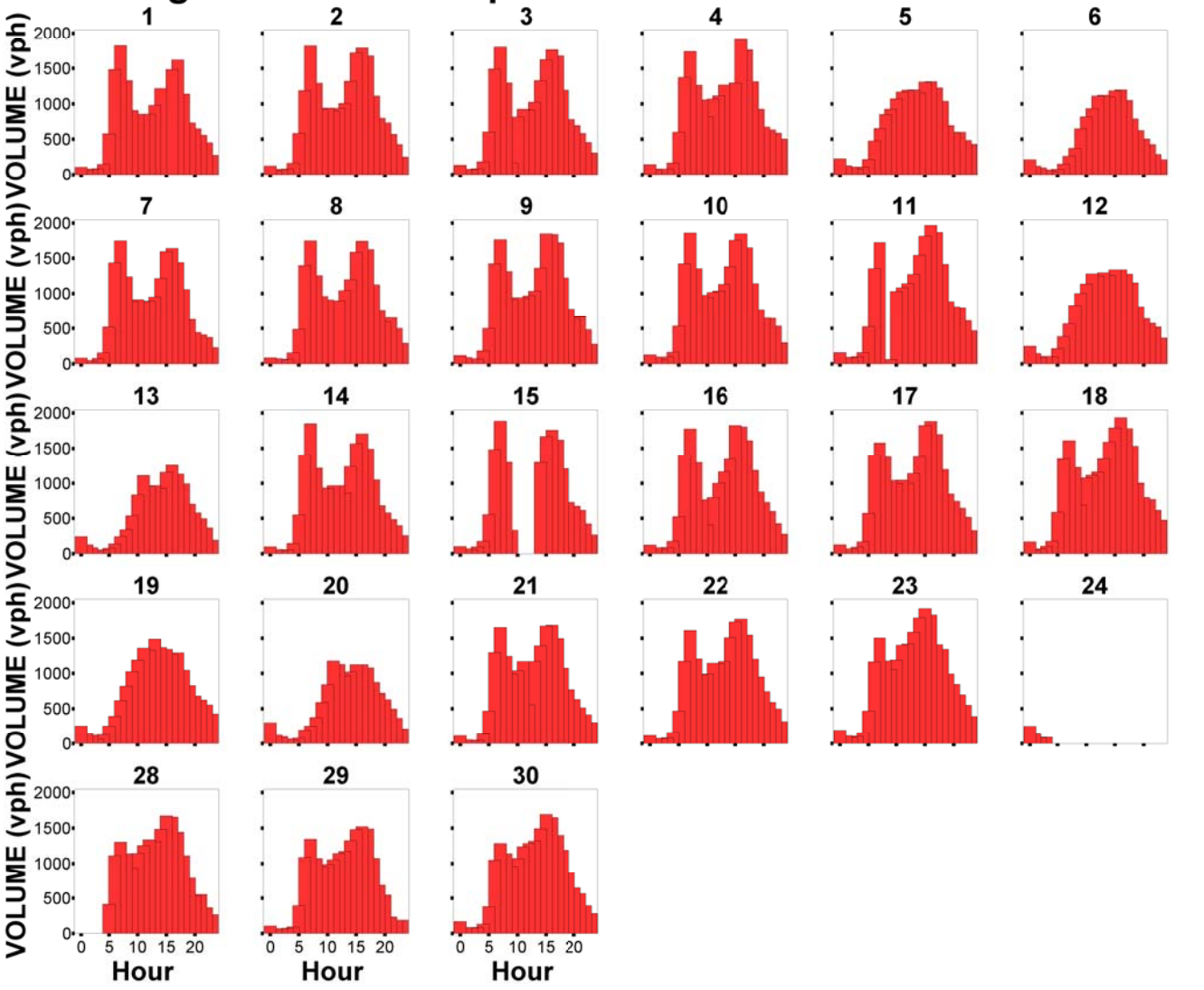


A5 Figure 16. Control Ramp: Detector D Speeds March 2001.

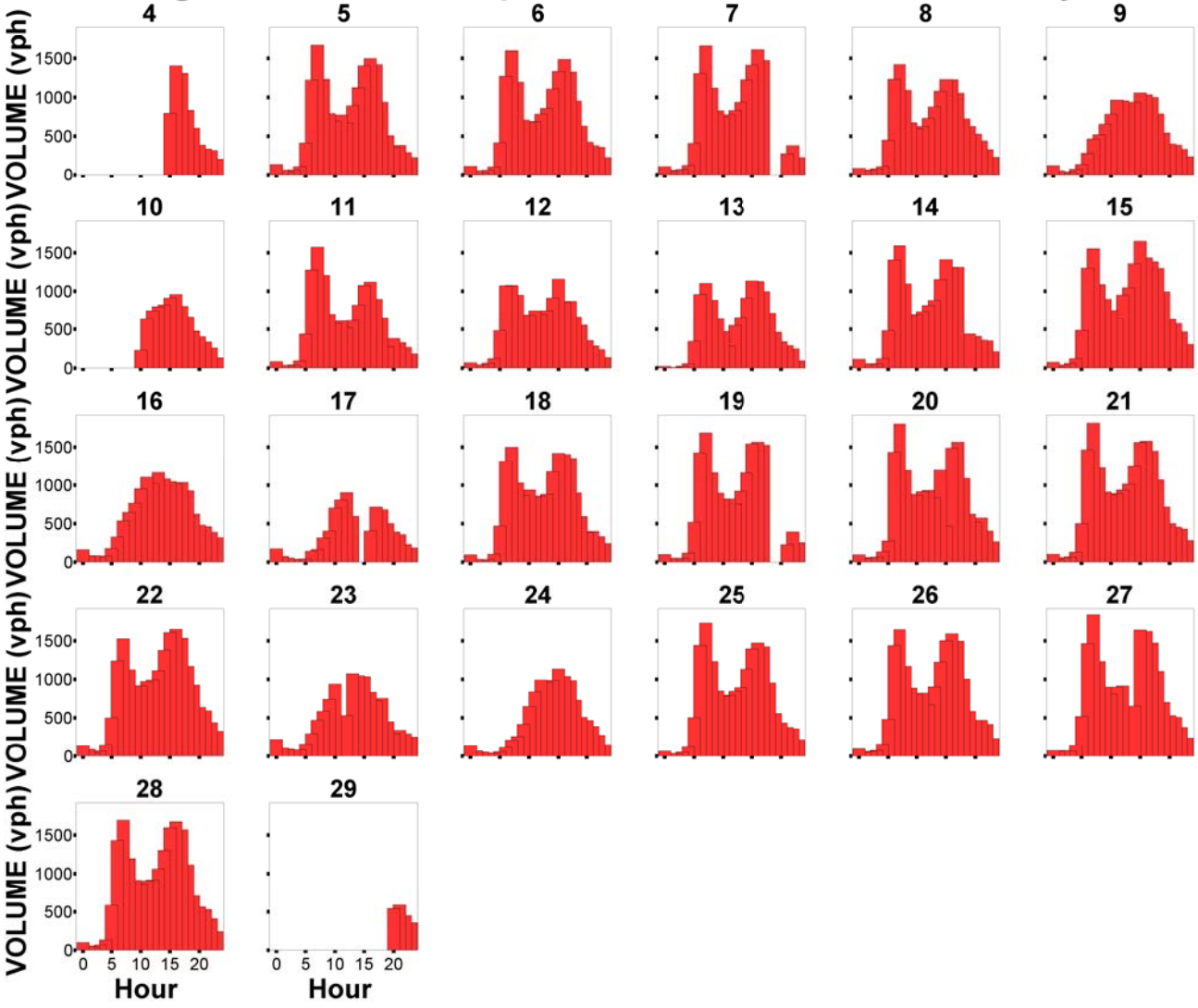


APPENDIX 6
Detector Volumes Before Period

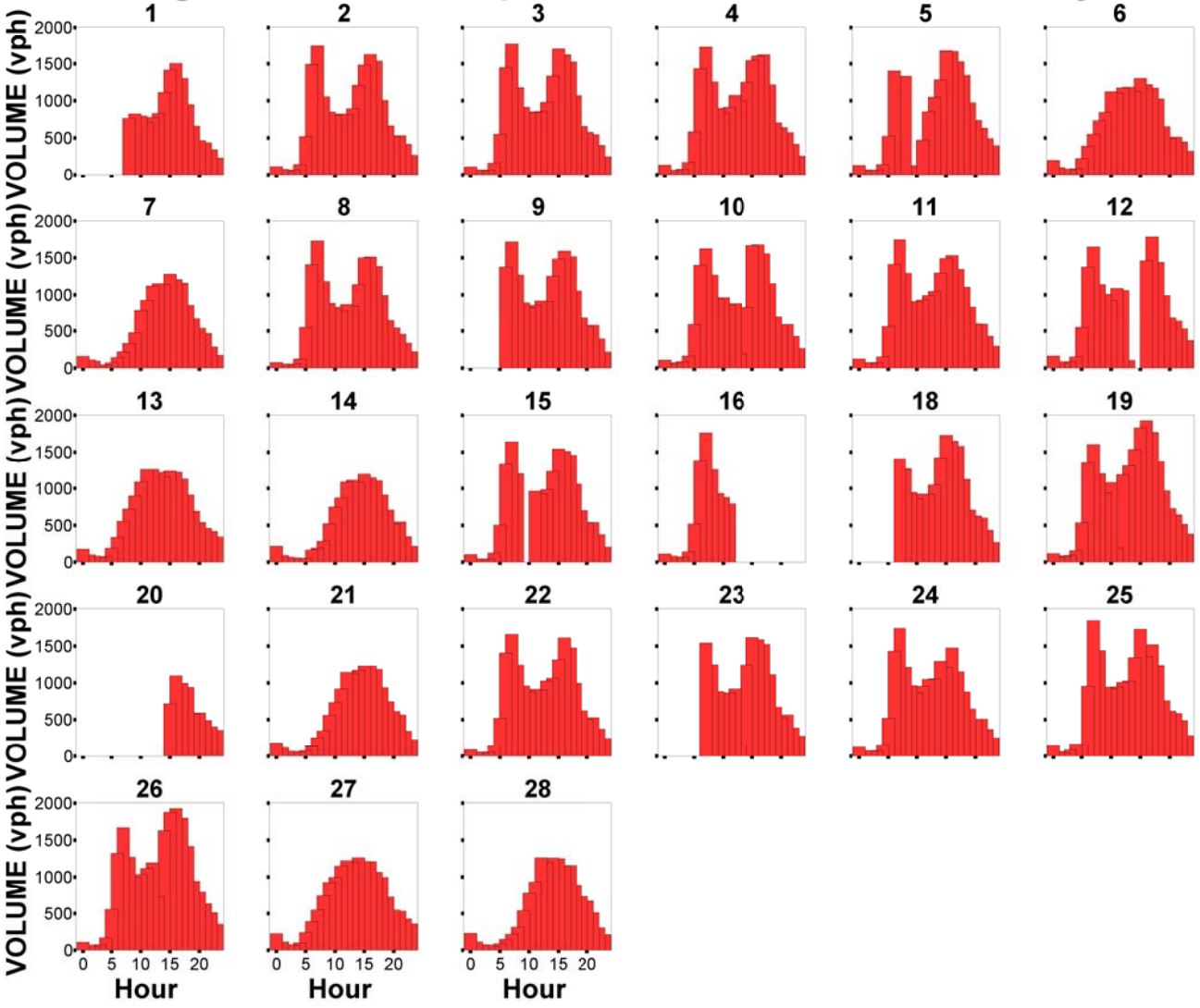
A6 Figure 1. Test Ramp: Detector A Volumes December 1998.



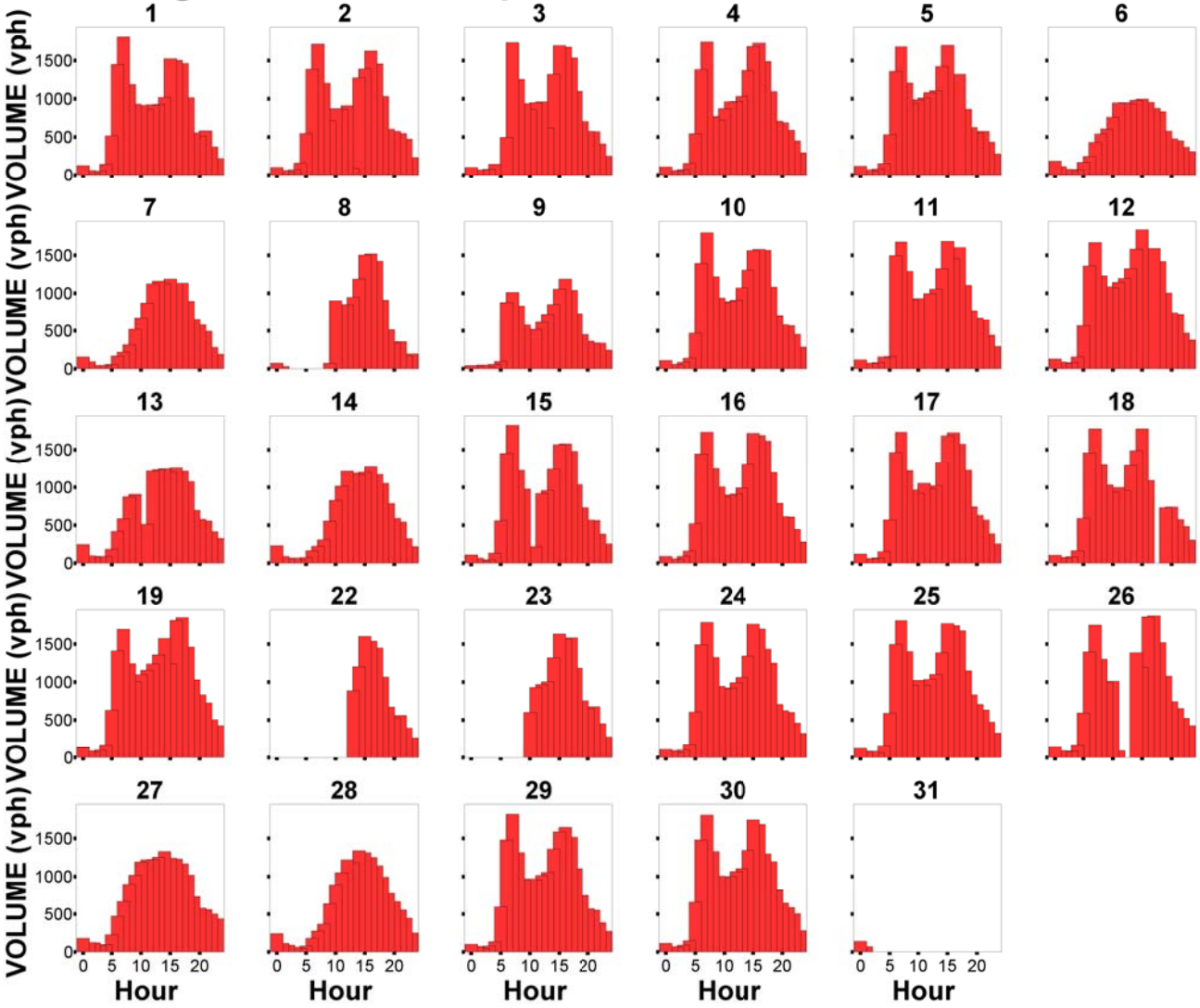
A6 Figure 2. Test Ramp: Detector A Volumes January 1999.



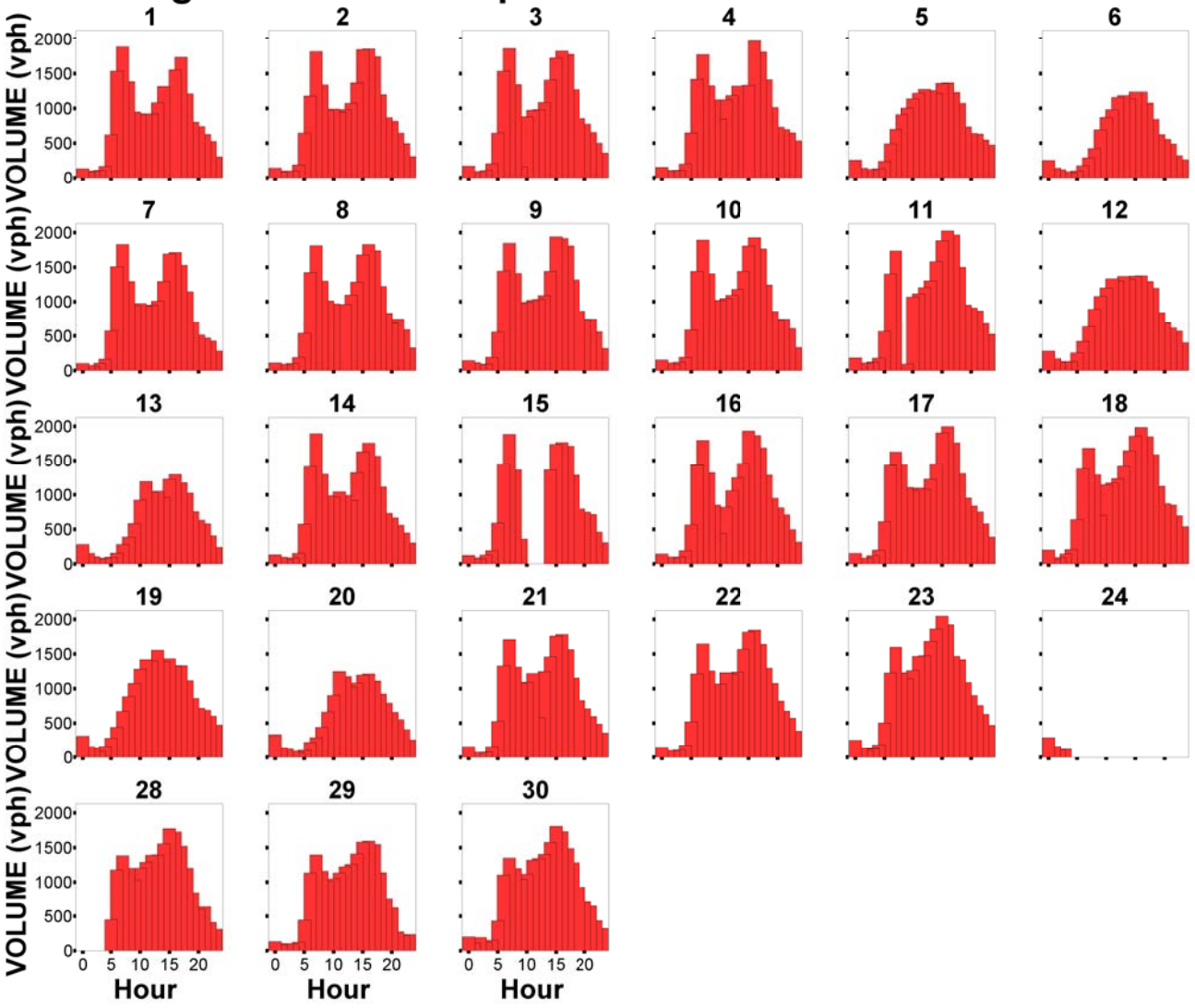
A6 Figure 3. Test Ramp: Detector A Volumes February 1999.



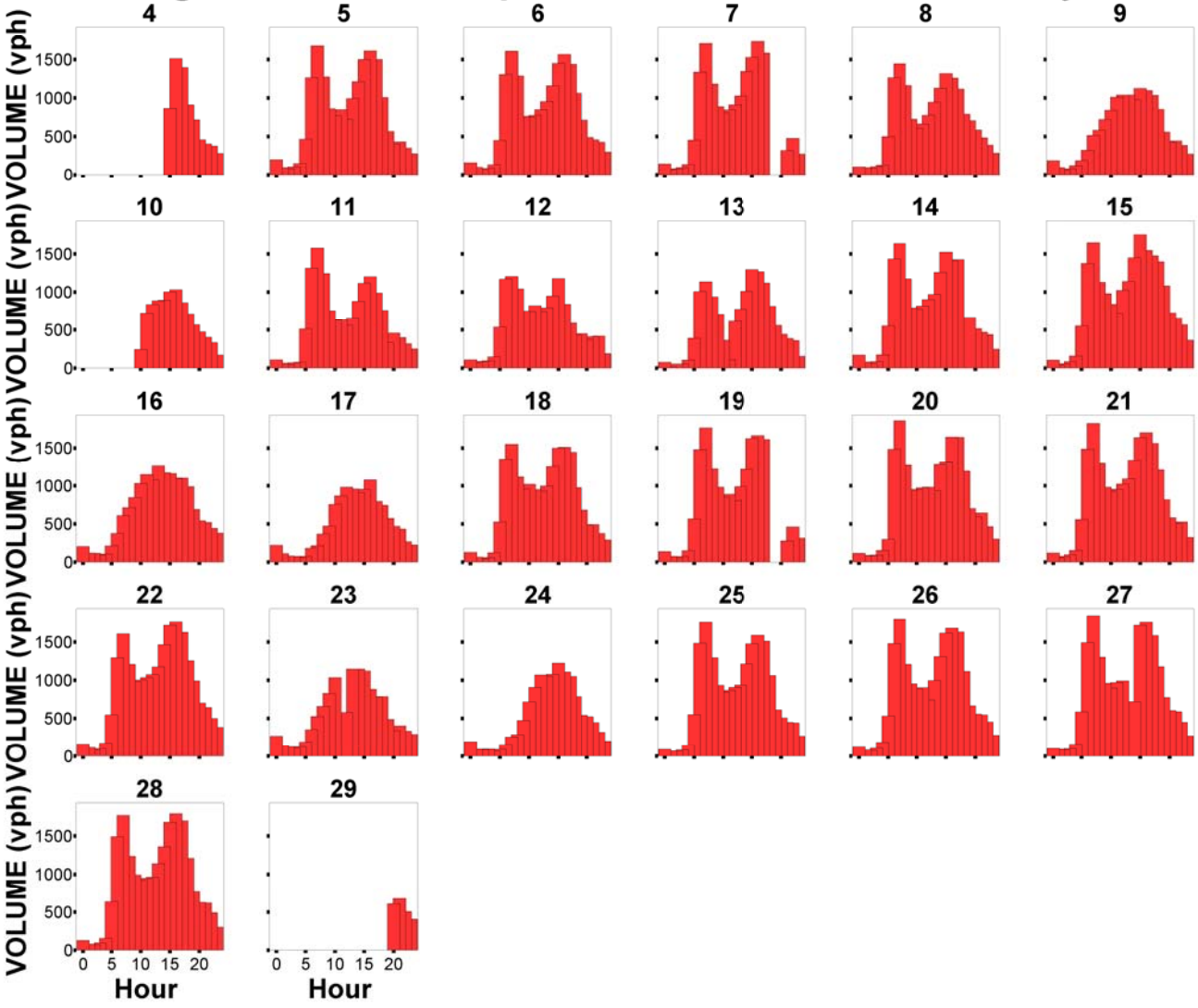
A6 Figure 4. Test Ramp: Detector A Volumes March 1999.



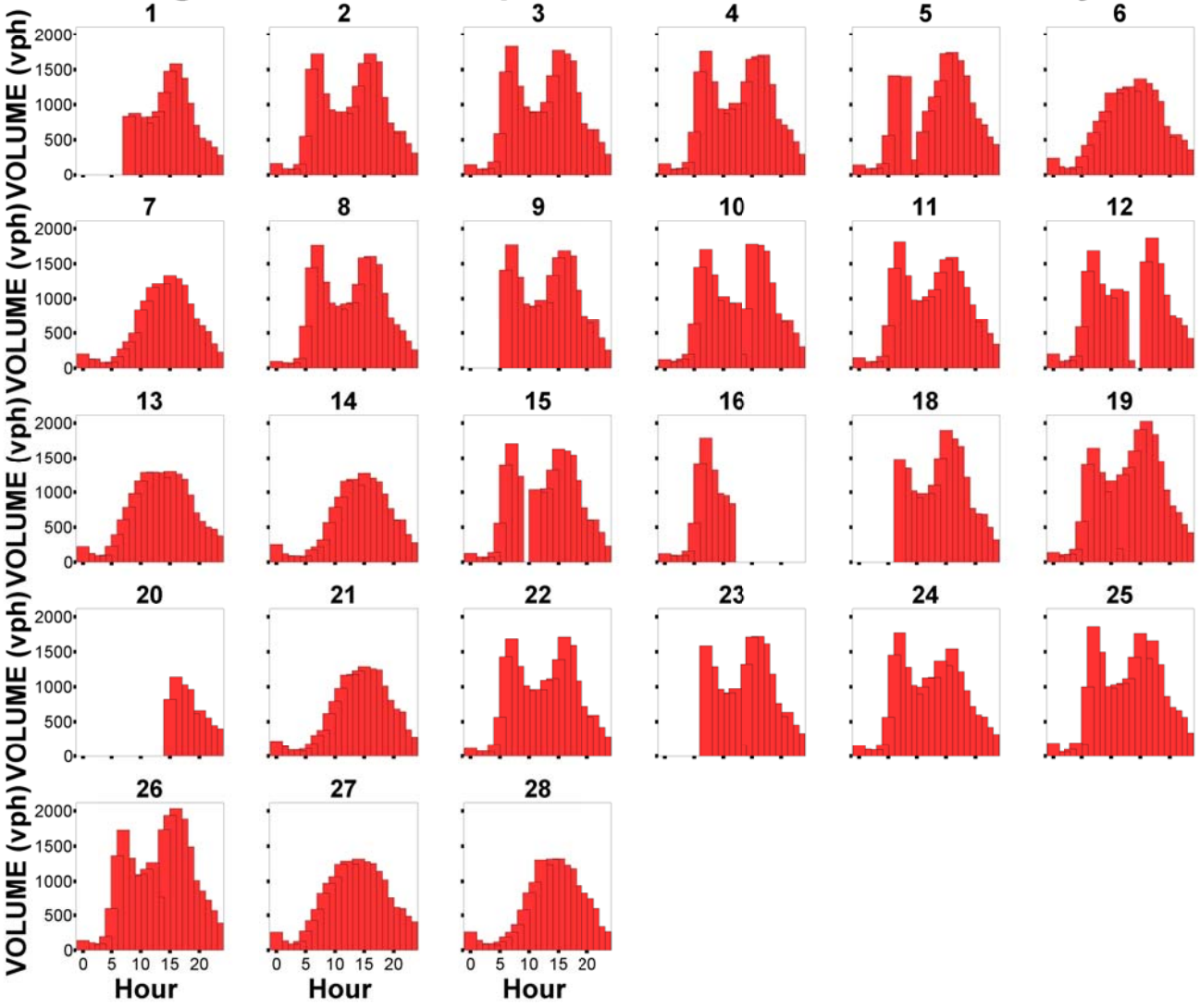
A6 Figure 5. Test Ramp: Detector B Volumes December 1998.



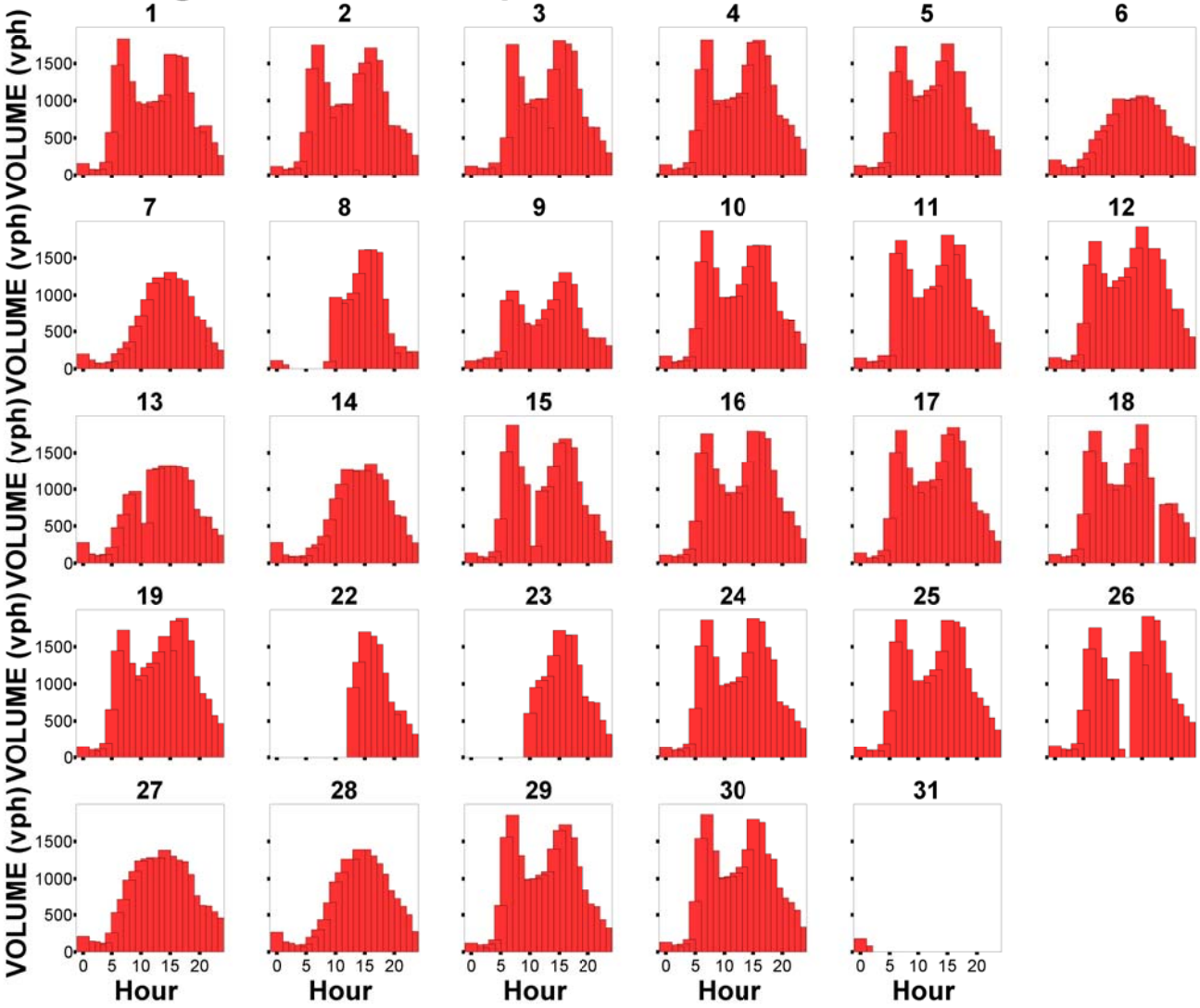
A6 Figure 6. Test Ramp: Detector B Volumes January 1999.



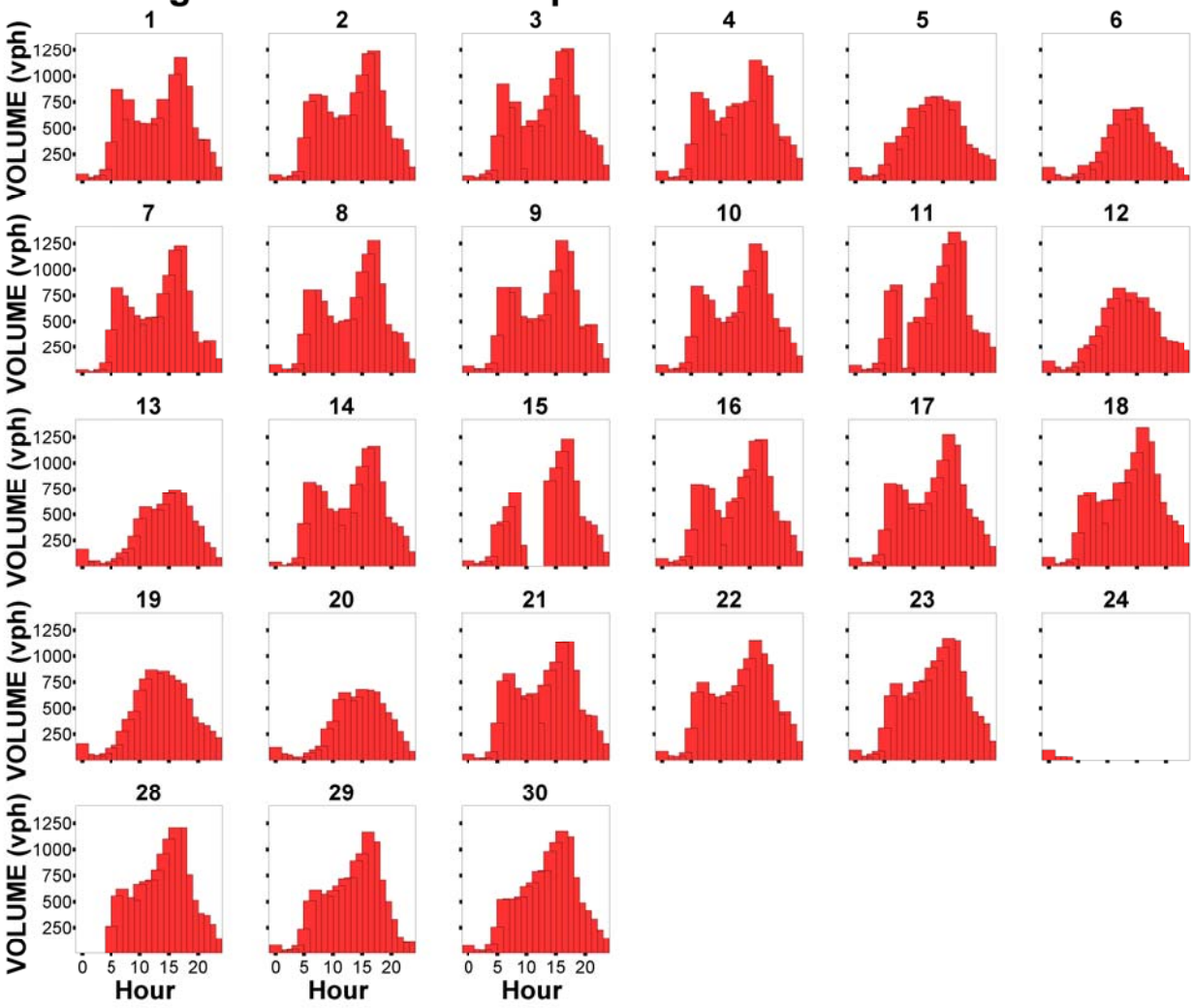
A6 Figure 7. Test Ramp: Detector B Volumes February 1999.



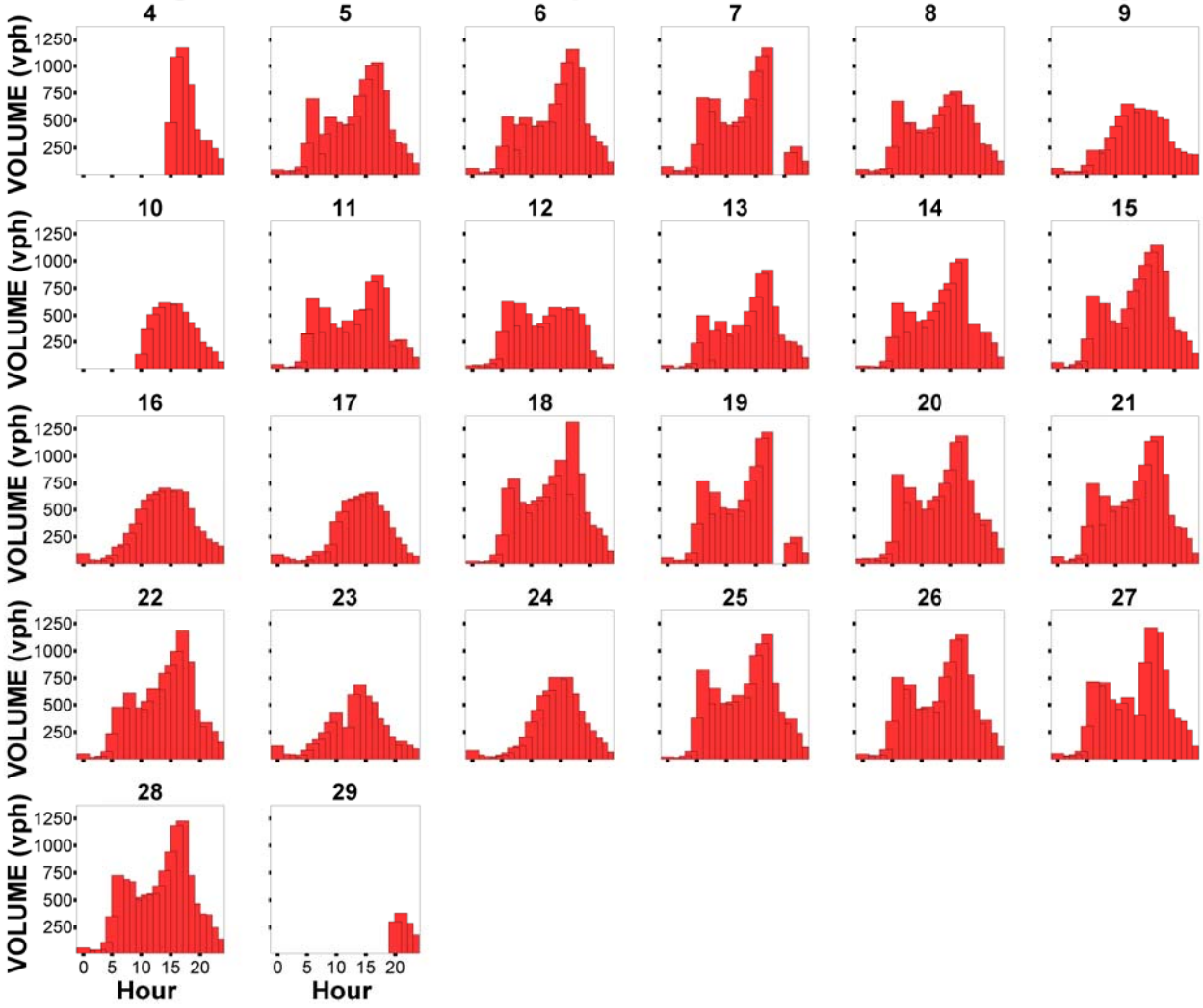
A6 Figure 8. Test Ramp: Detector B Volumes March 1999.



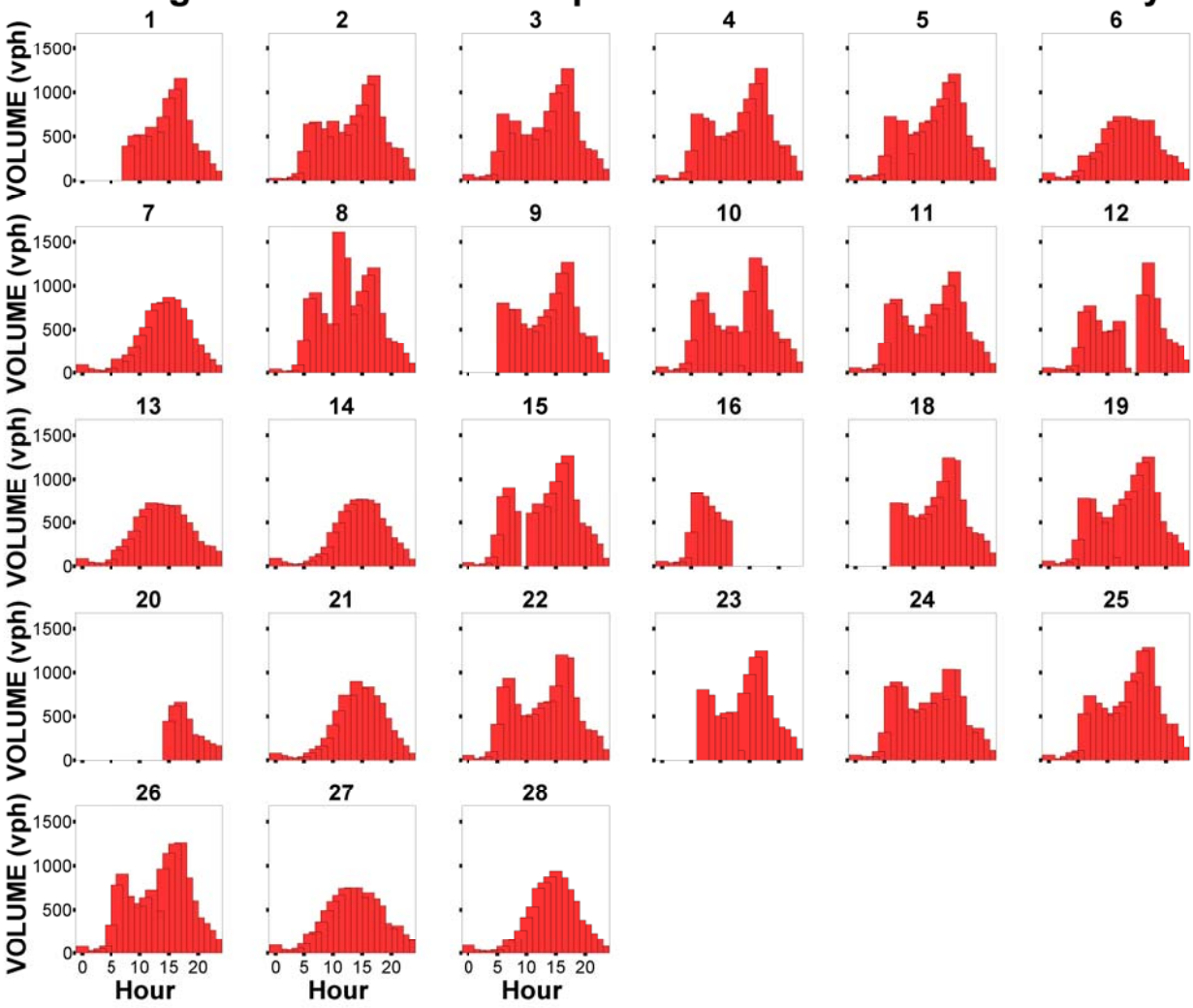
A6 Figure 9. Control Ramp: Detector C Volumes December 1998.



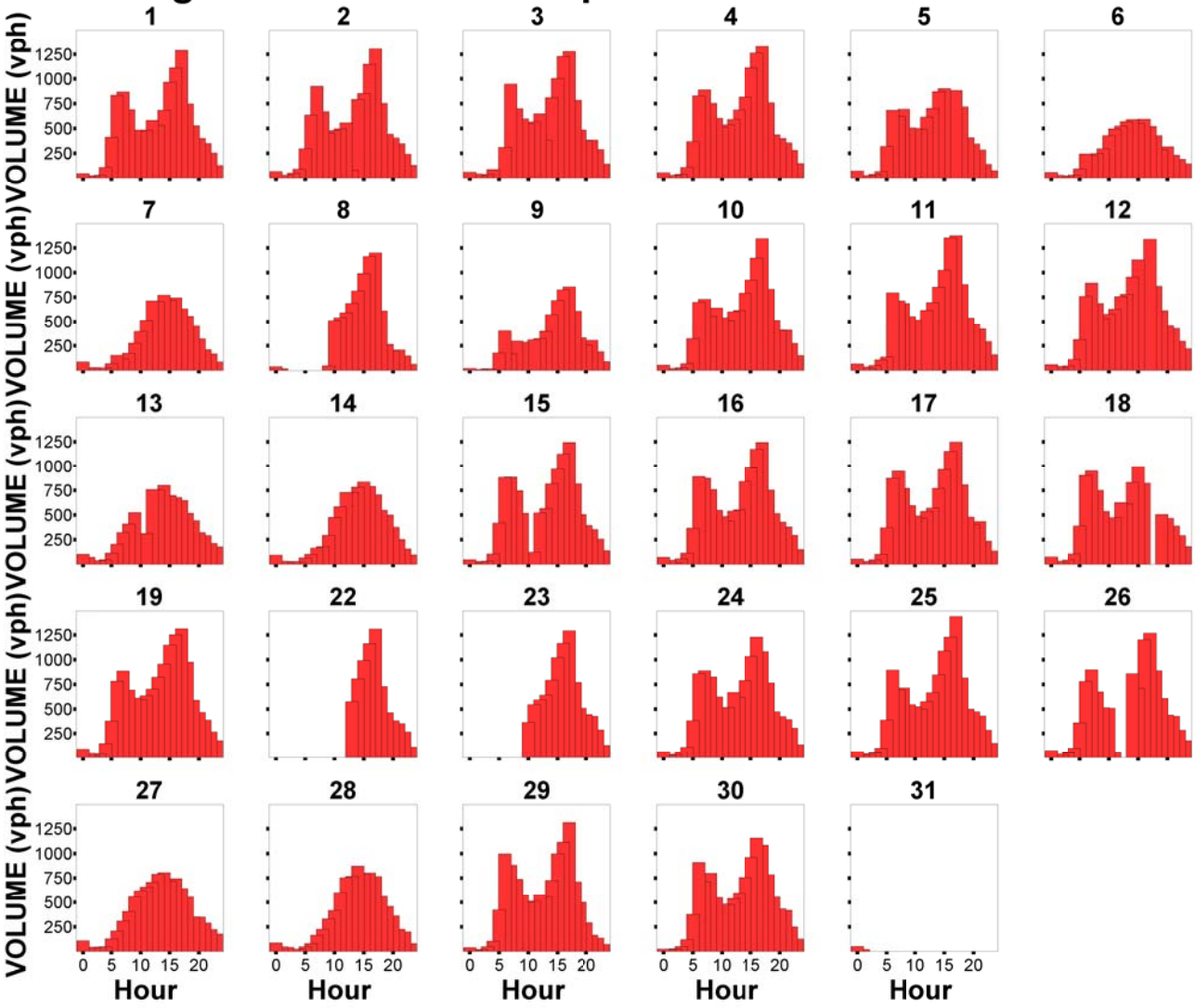
A6 Figure 10. Control Ramp: Detector C Volumes January 1999.



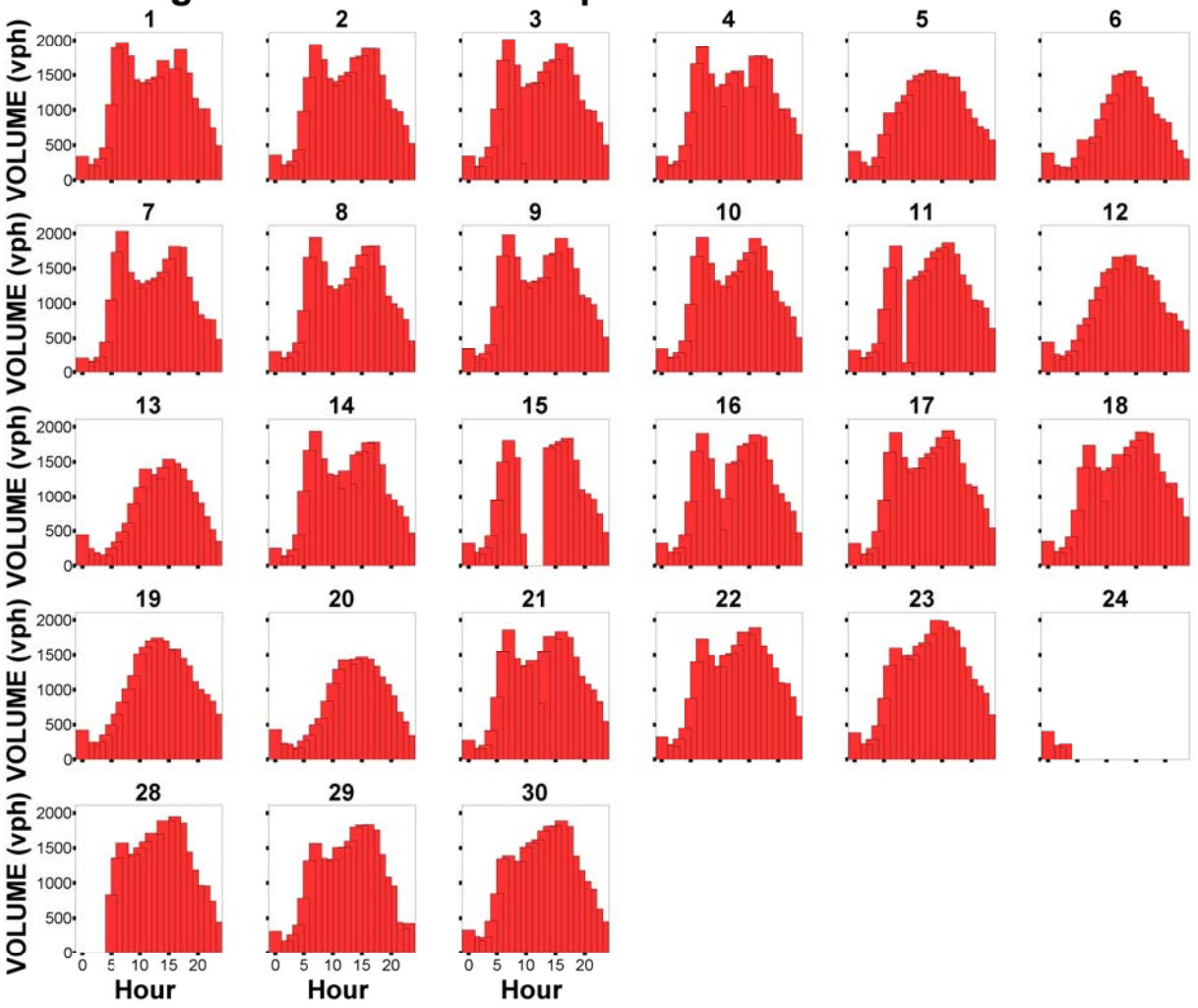
A6 Figure 11. Control Ramp: Detector C Volumes February 1999.



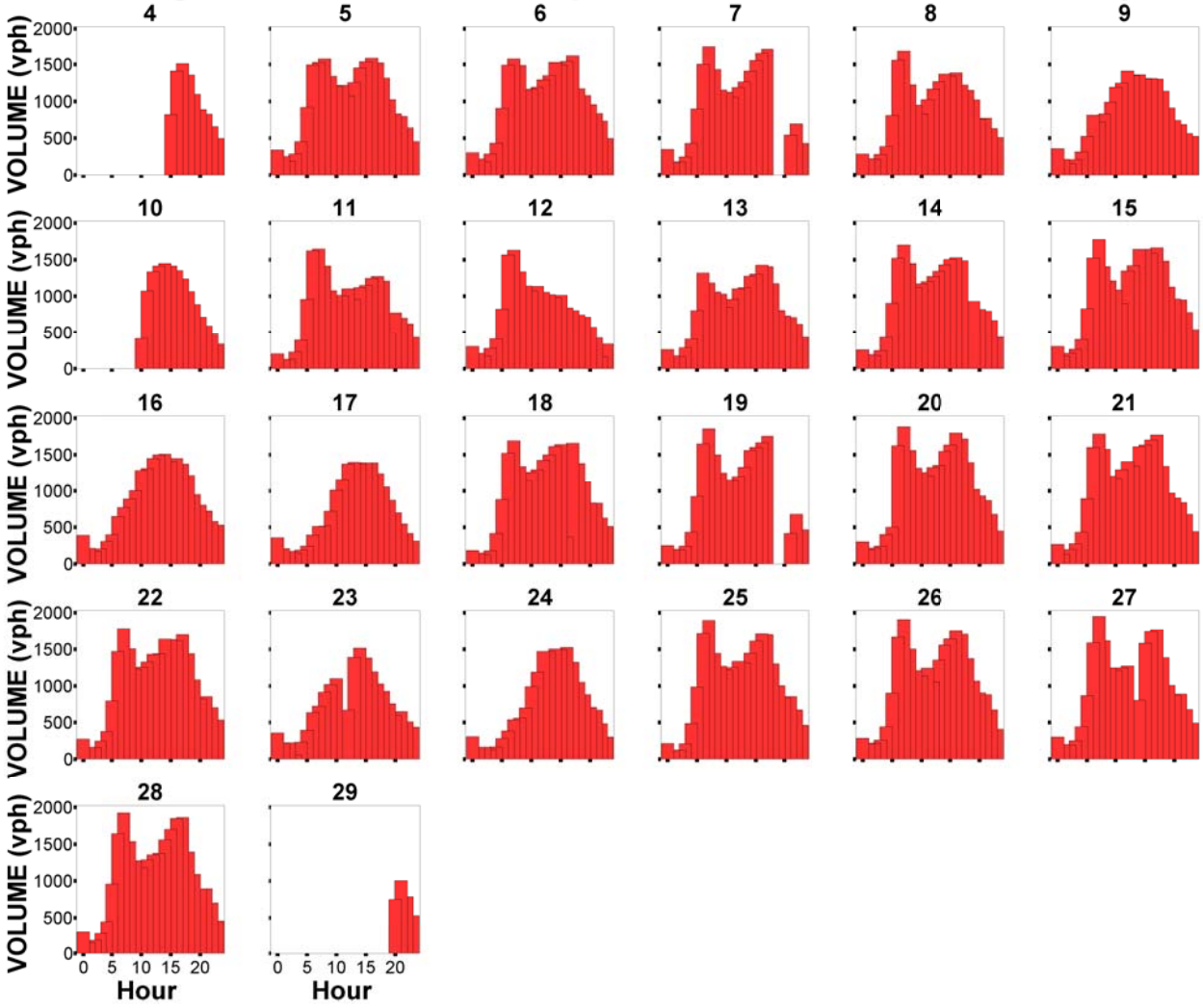
A6 Figure 12. Control Ramp: Detector C Volumes March 1999.



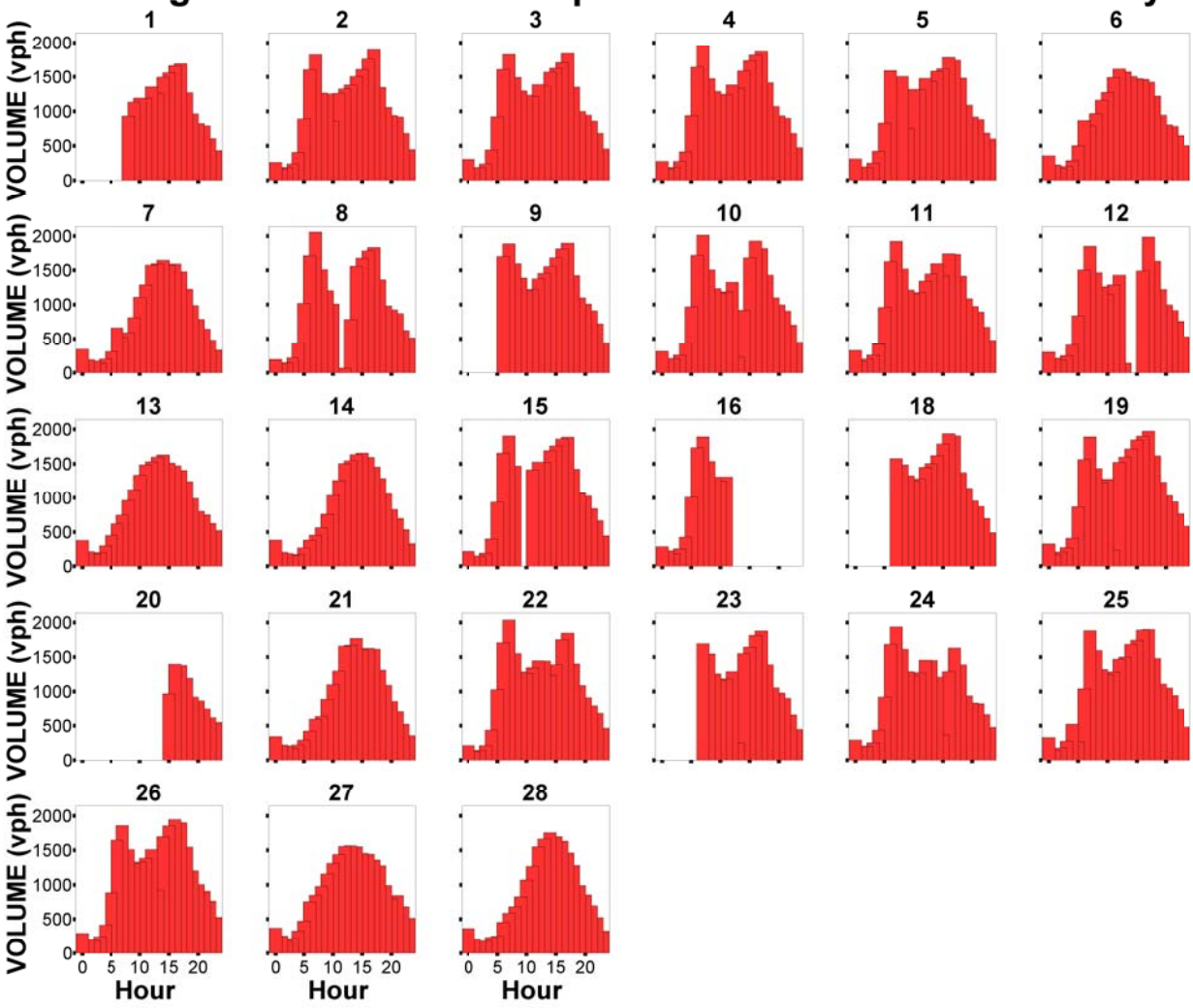
A6 Figure 13. Control Ramp: Detector D Volumes December 1998.



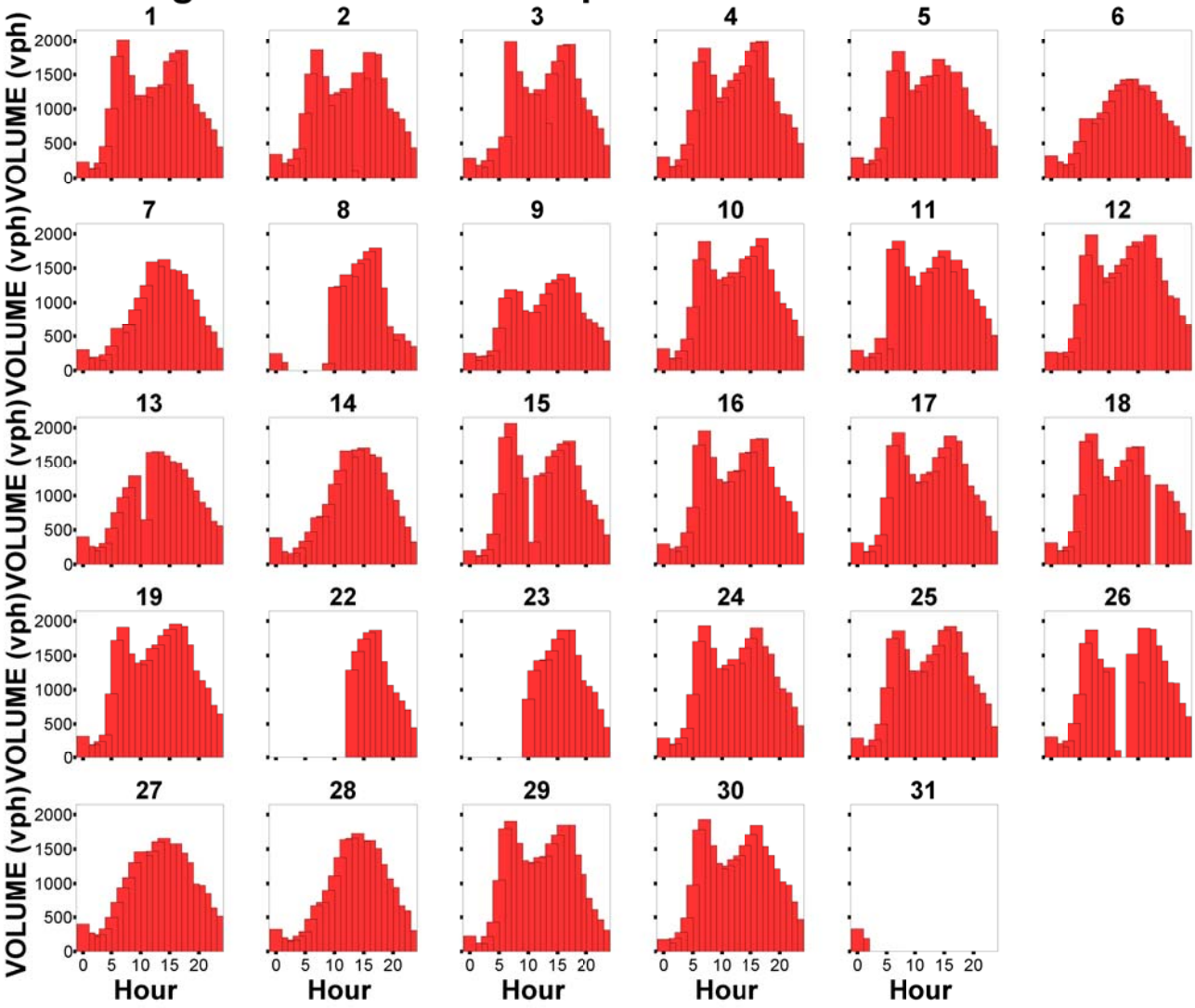
A6 Figure 14. Control Ramp: Detector D Volumes January 1999.



A6 Figure 15. Control Ramp: Detector D Volumes February 1999.

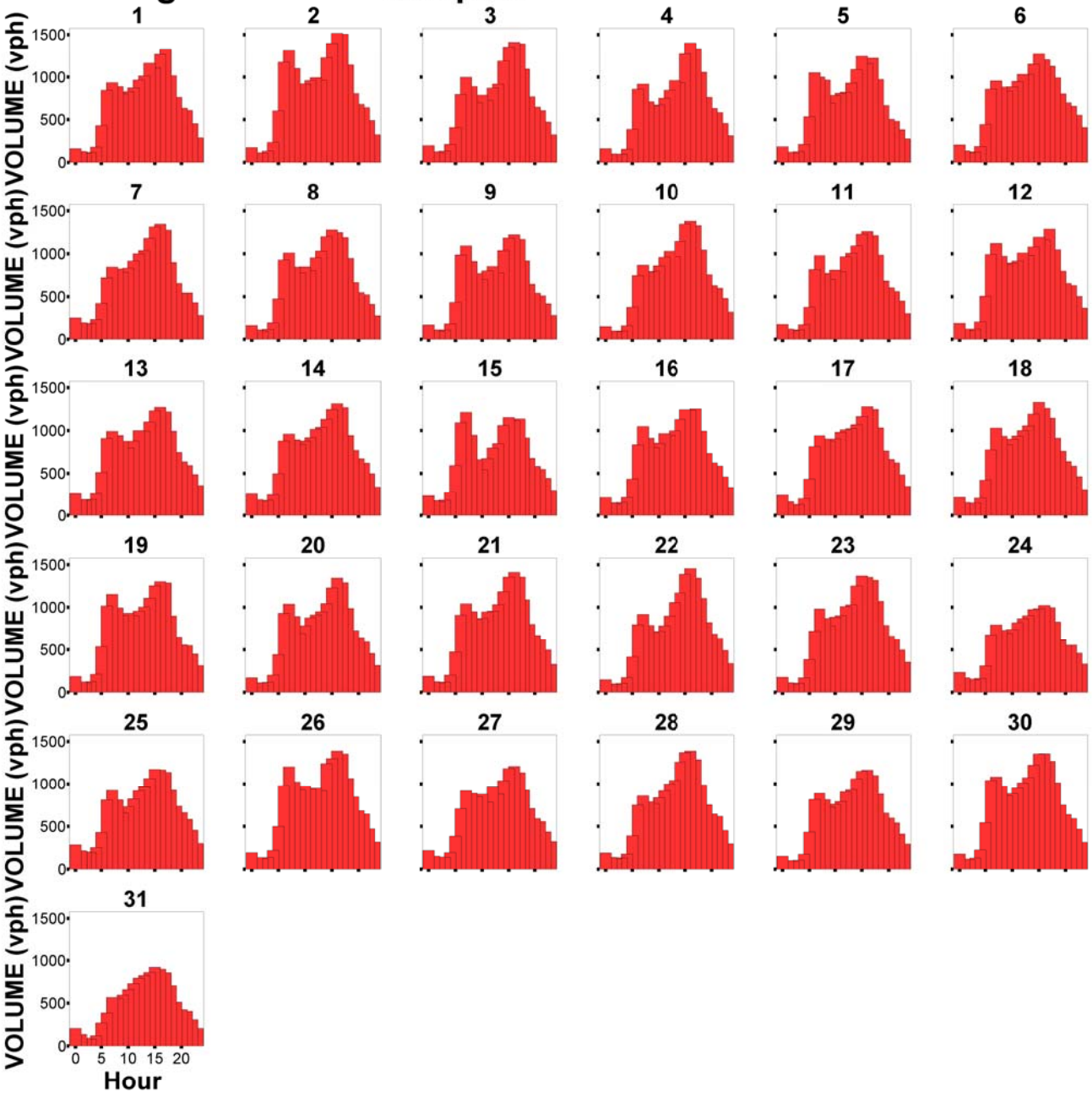


A6 Figure 16. Control Ramp: Detector D Volumes March 1999.

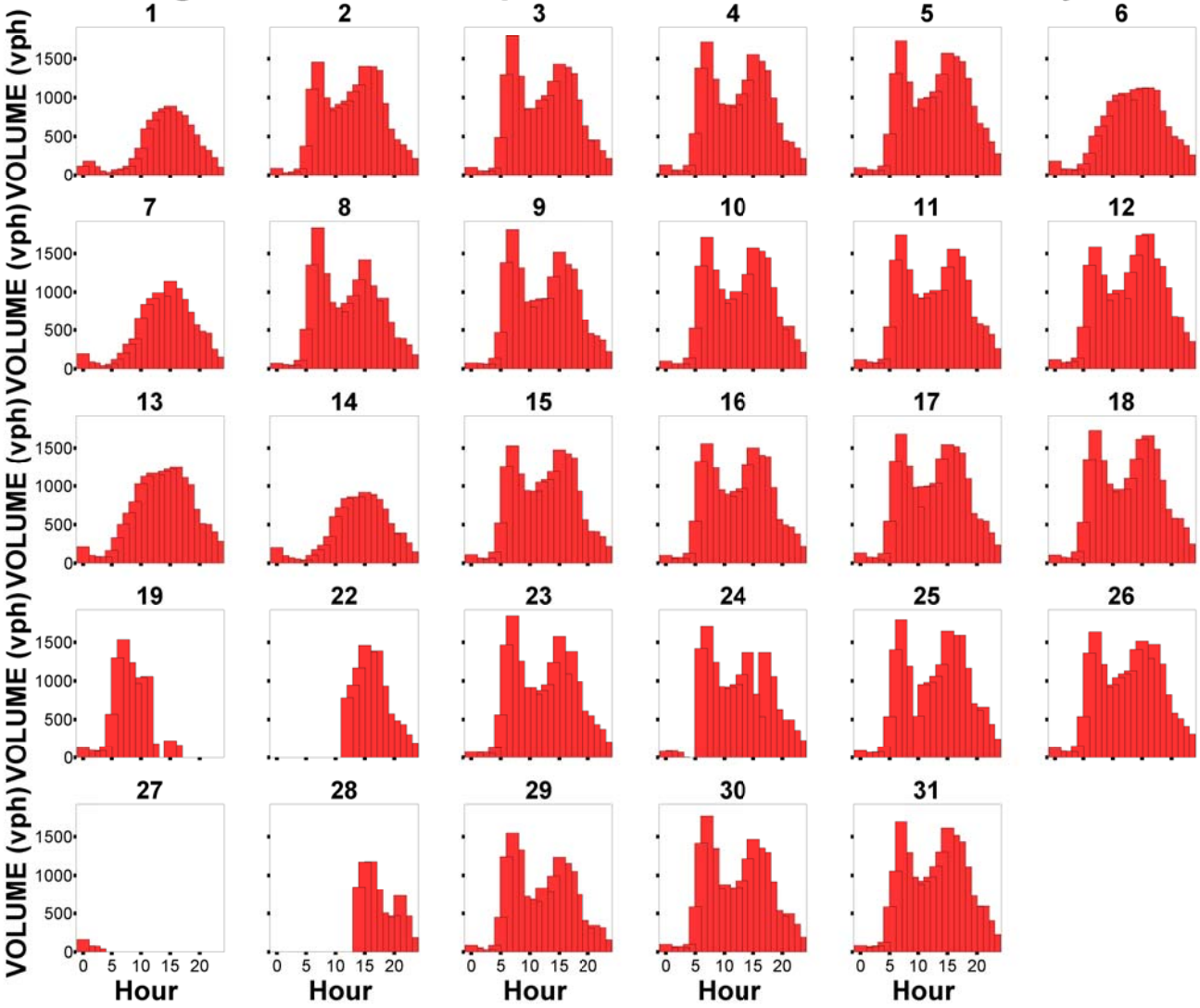


APPENDIX 7
Detector Volumes After Period

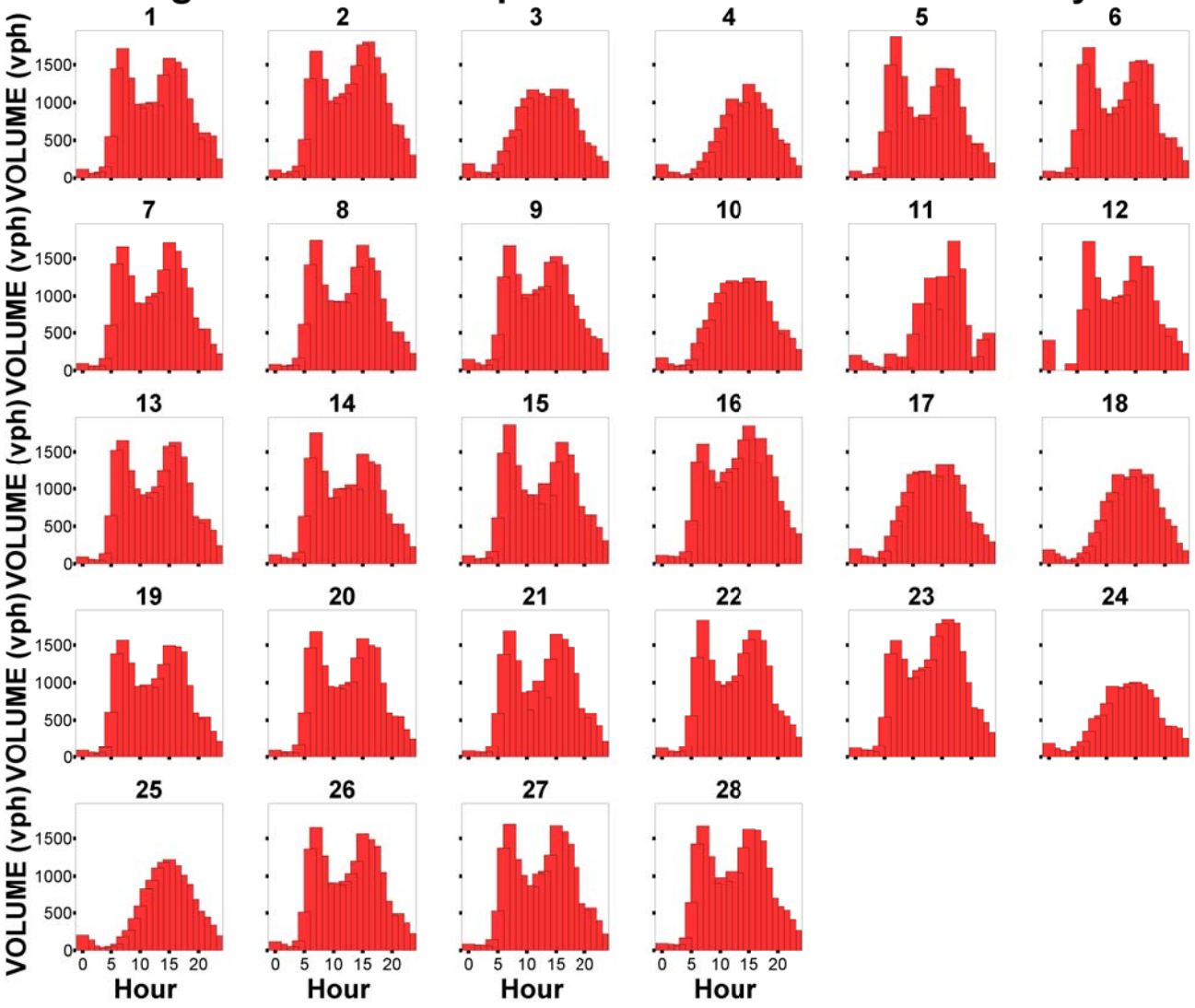
A7 Figure 1. Test Ramp: Detector A Volumes December 2000.



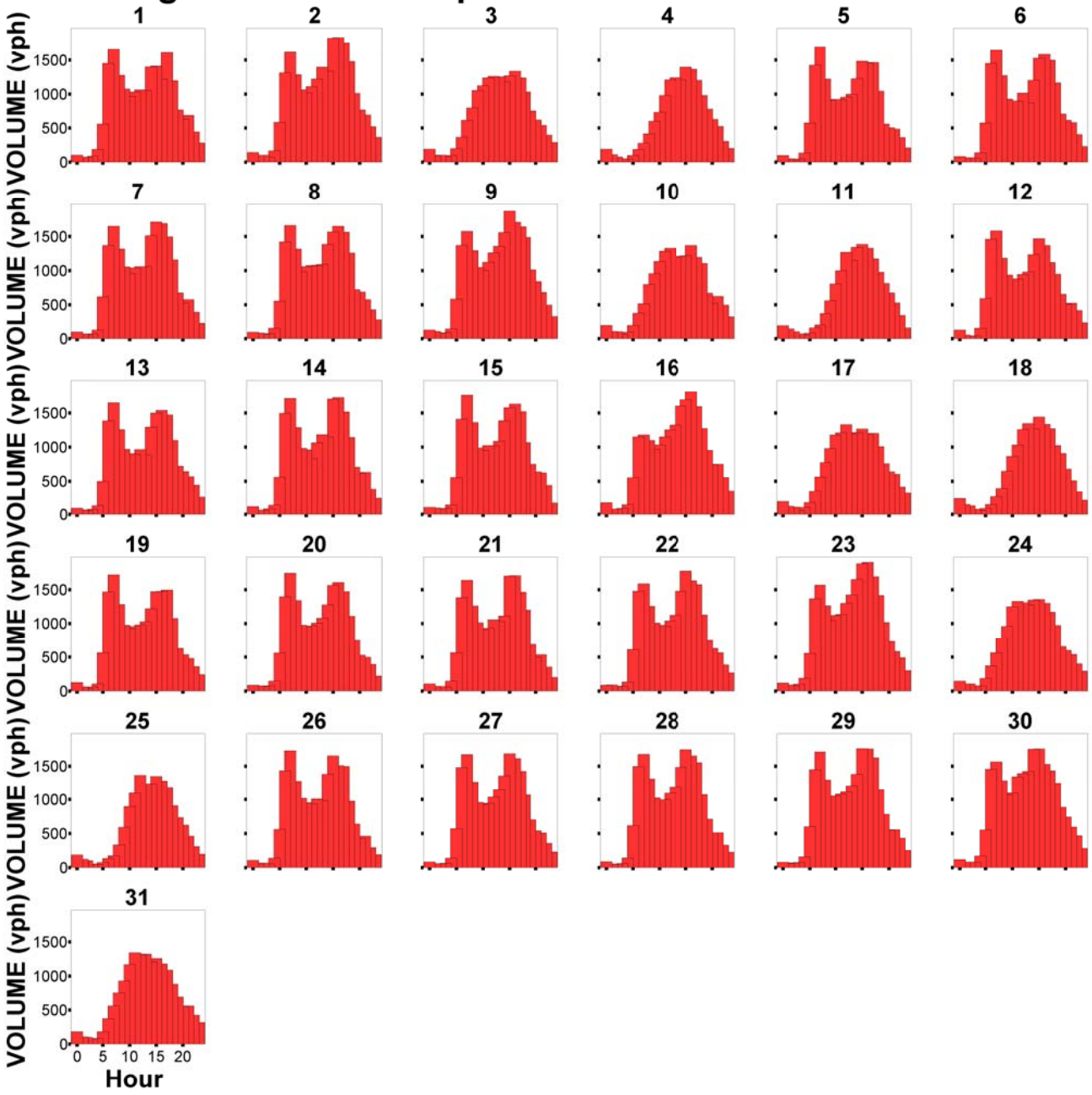
A7 Figure 2. Test Ramp: Detector A Volumes January 2001.



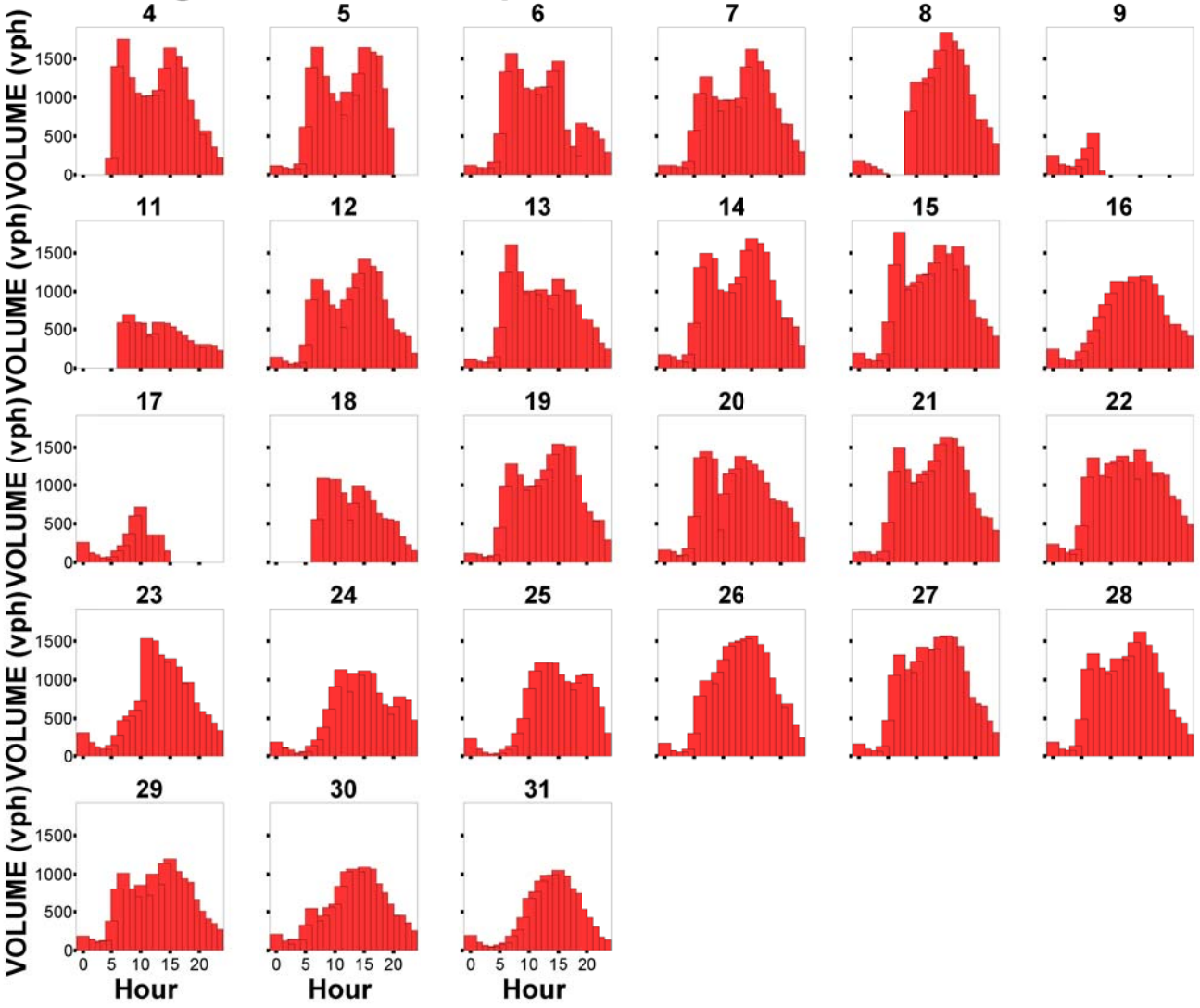
A7 Figure 3. Test Ramp: Detector A Volumes February 2001.



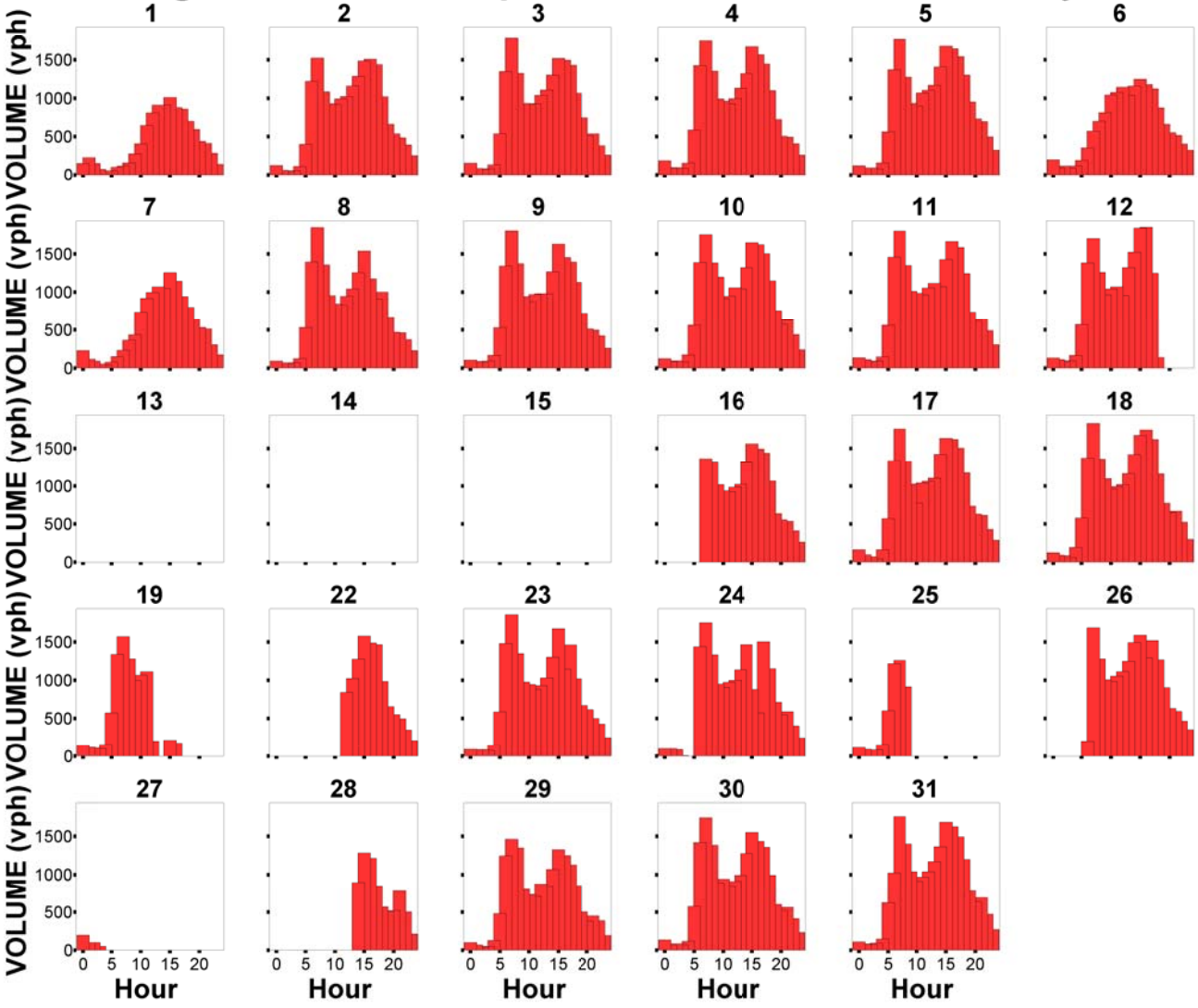
A7 Figure 4. Test Ramp: Detector A Volumes March 2001.



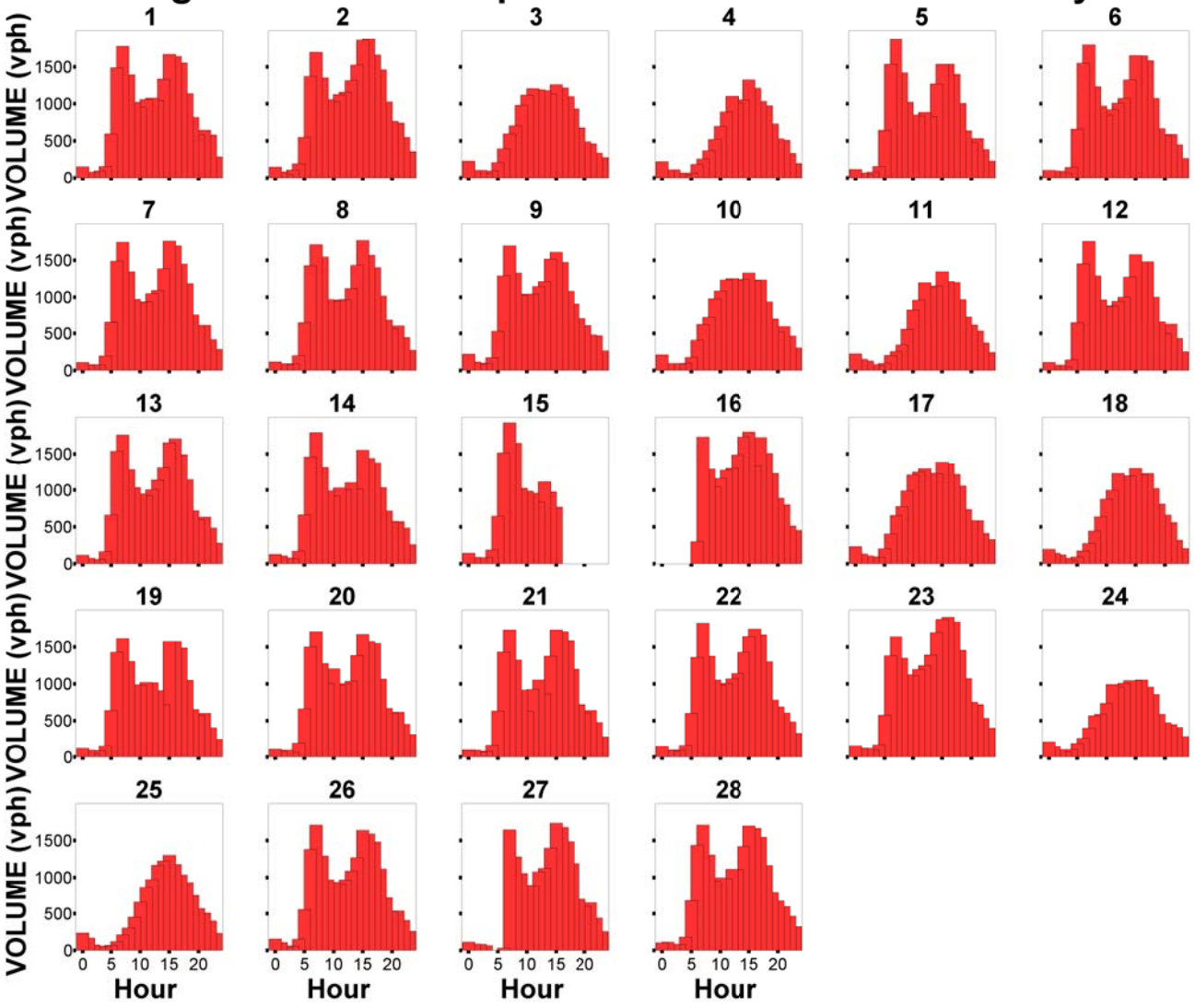
A7 Figure 5. Test Ramp: Detector B Volumes December 2000.



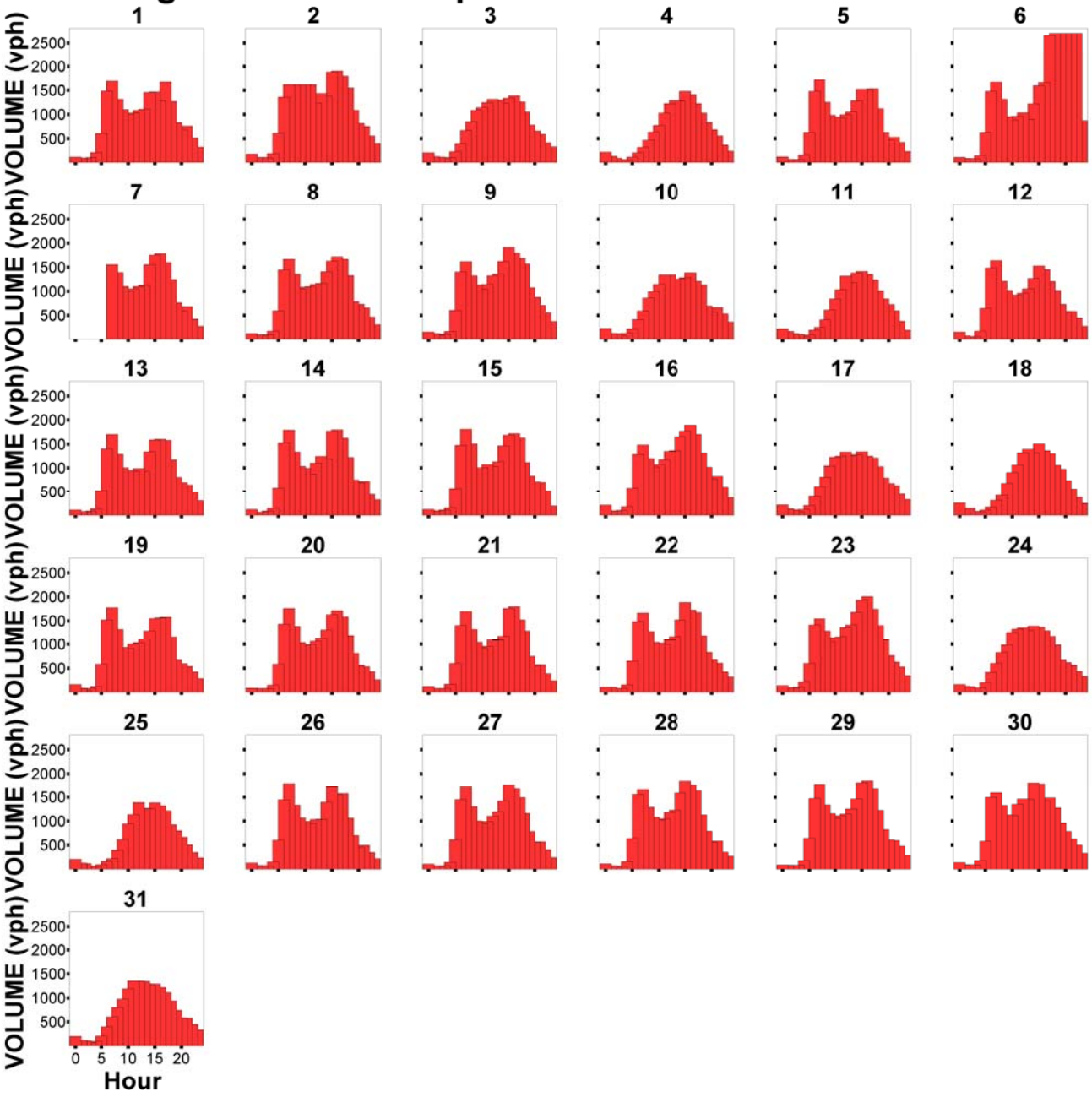
A7 Figure 6. Test Ramp: Detector B Volumes January 2001.



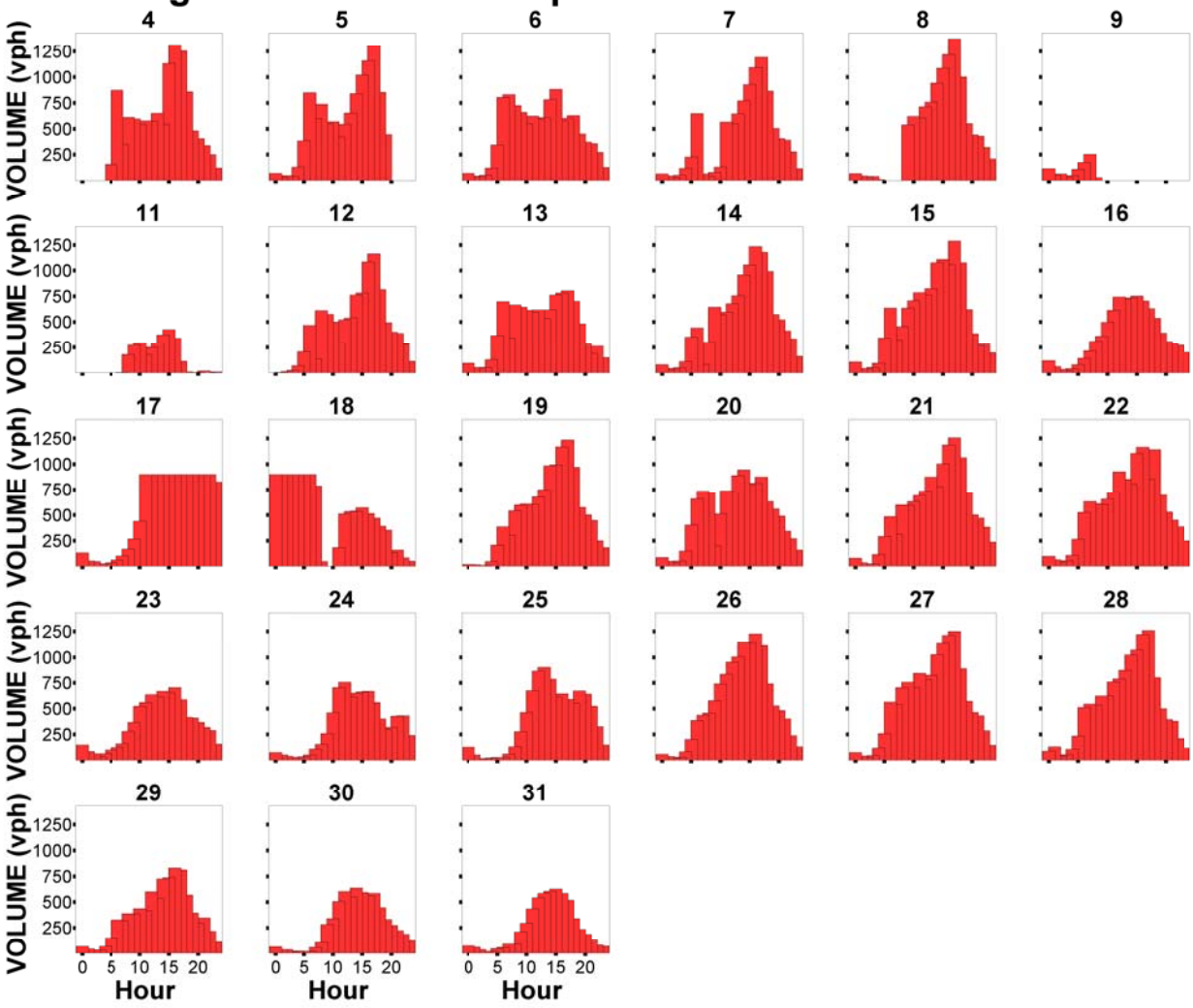
A7 Figure 7. Test Ramp: Detector B Volumes February 2001.



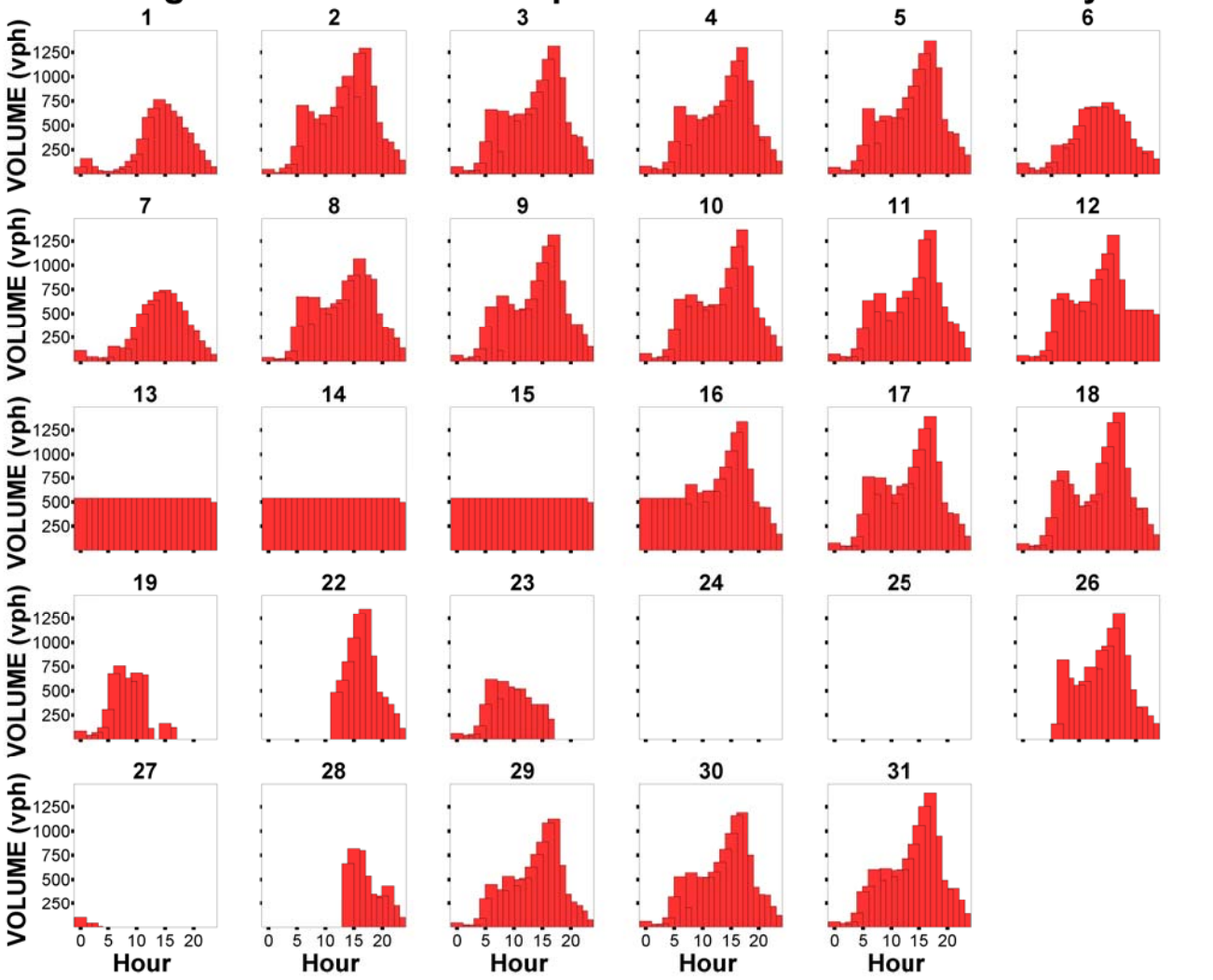
A7 Figure 8. Test Ramp: Detector B Volumes March 2001.



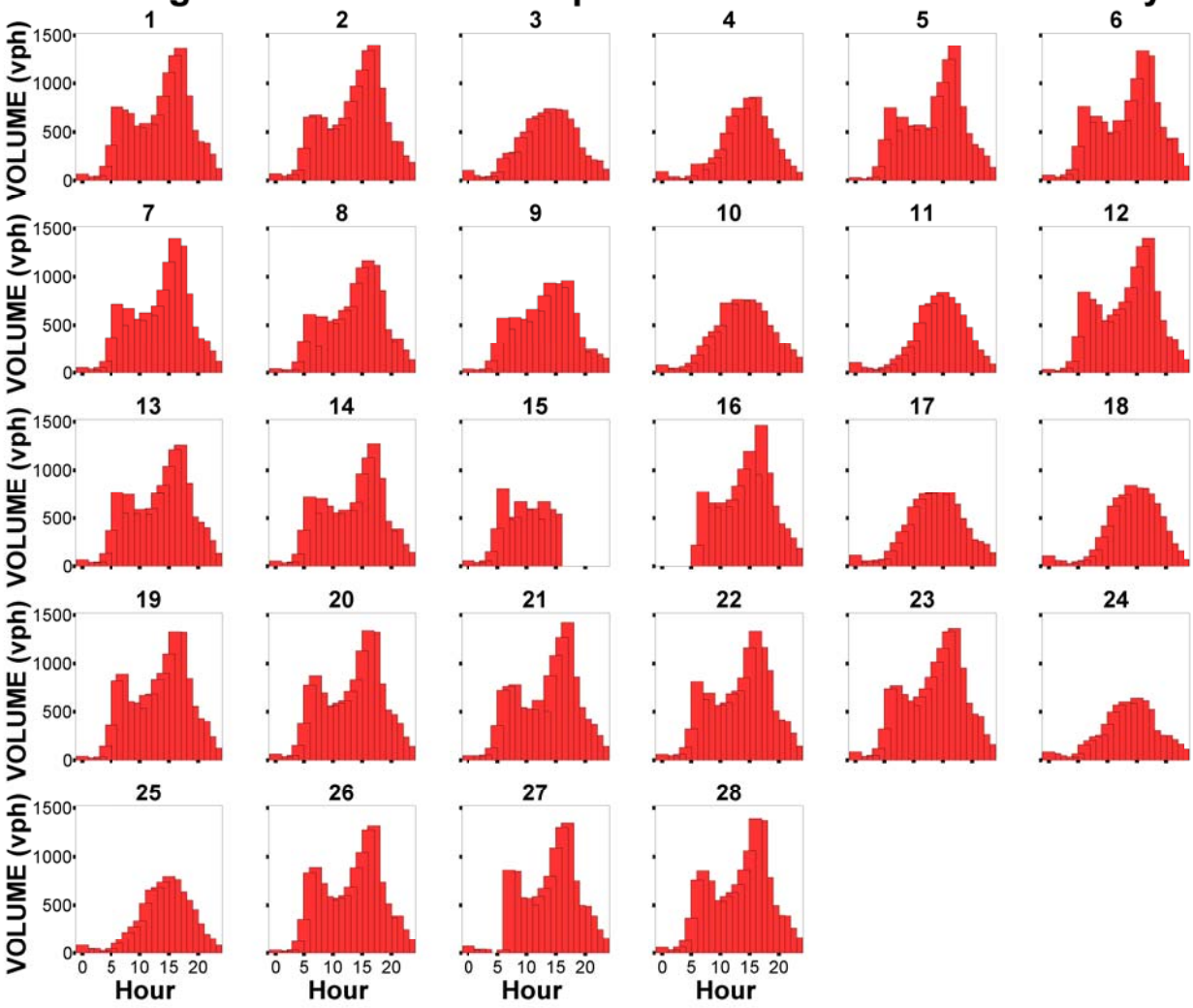
A7 Figure 9. Control Ramp: Detector C Volumes December 2000.



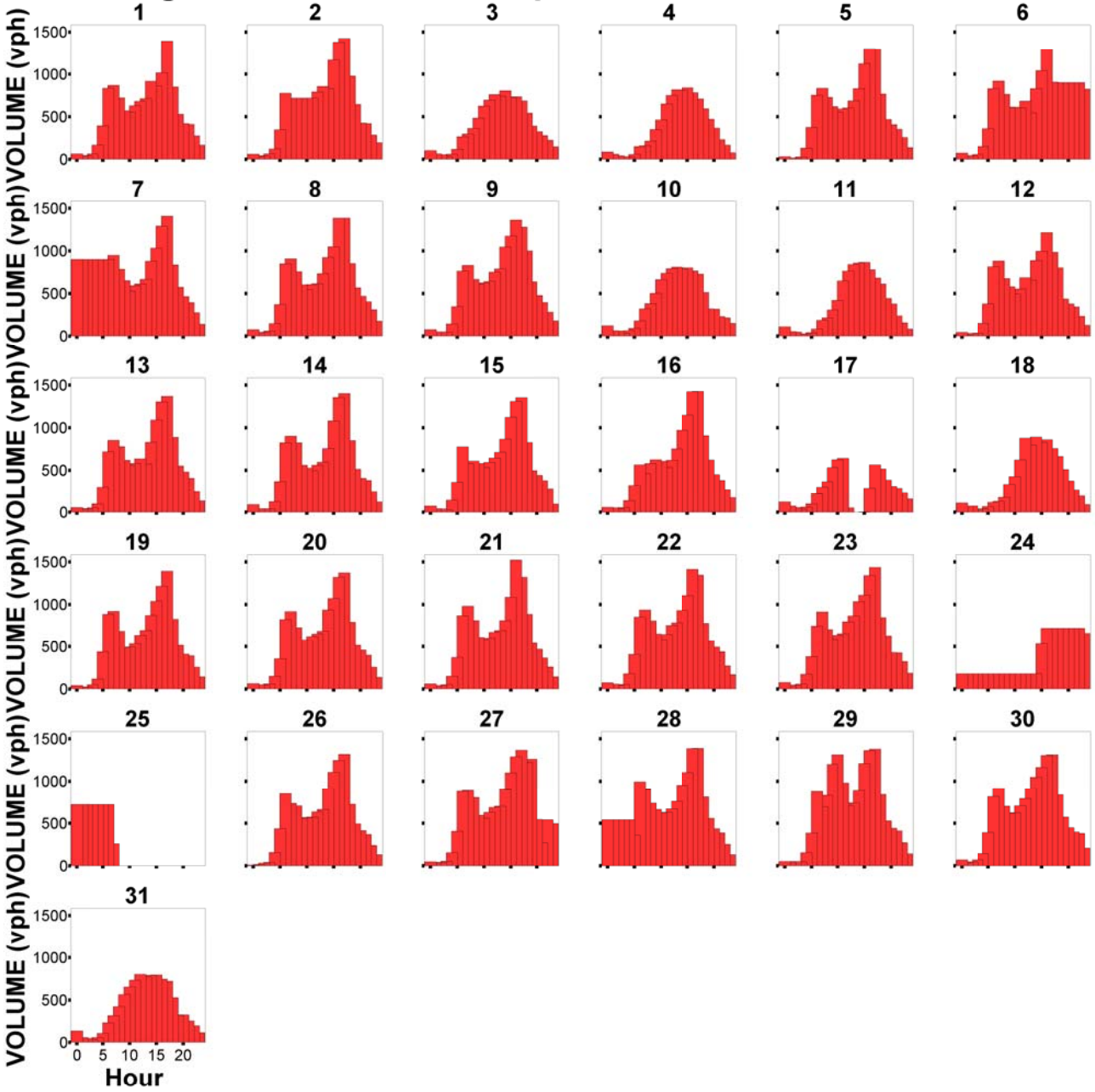
A7 Figure 10. Control Ramp: Detector C Volumes January 2001.



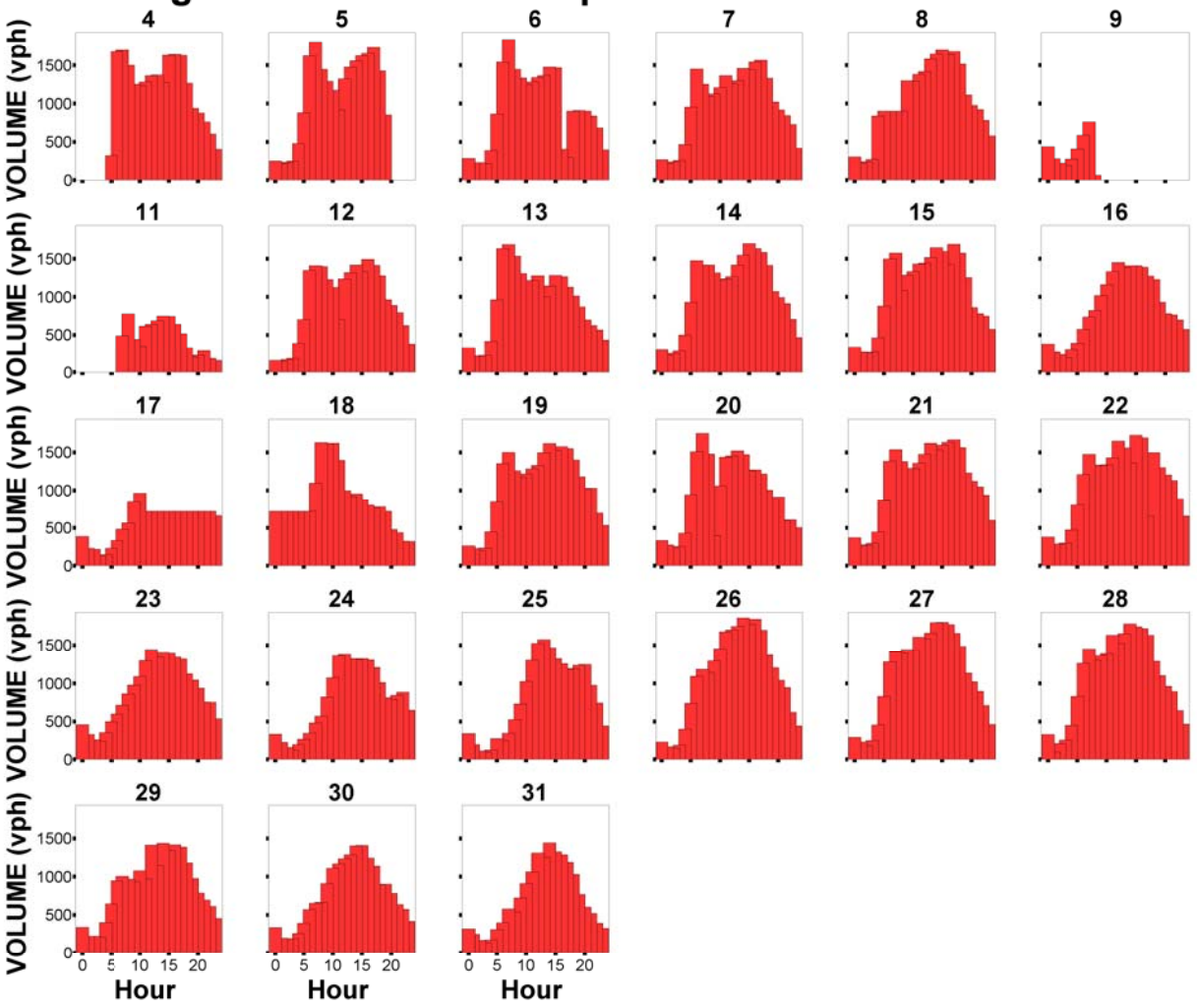
A7 Figure 11. Control Ramp: Detector C Volumes February 2001.



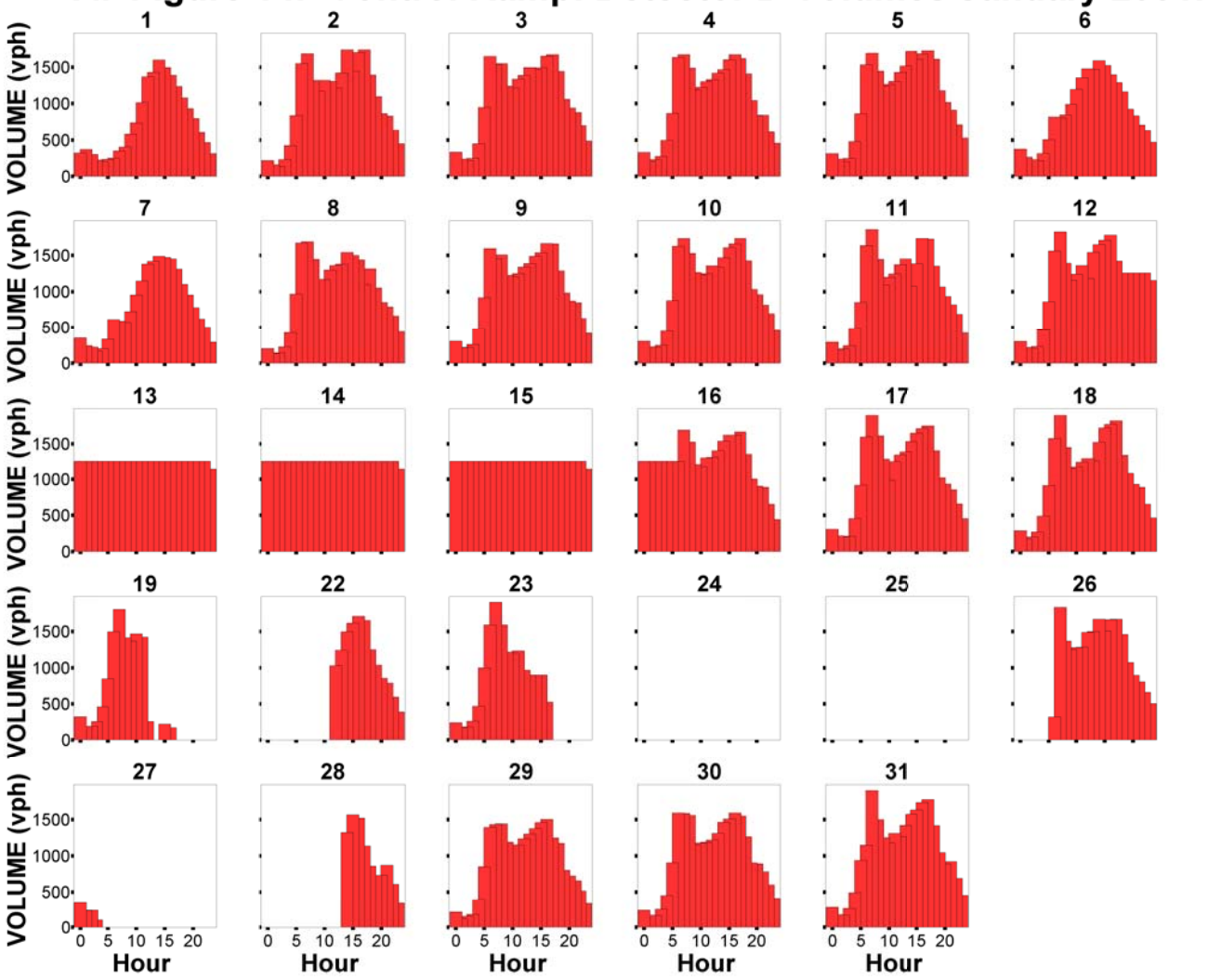
A7 Figure 12. Control Ramp: Detector C Volumes March 2001.



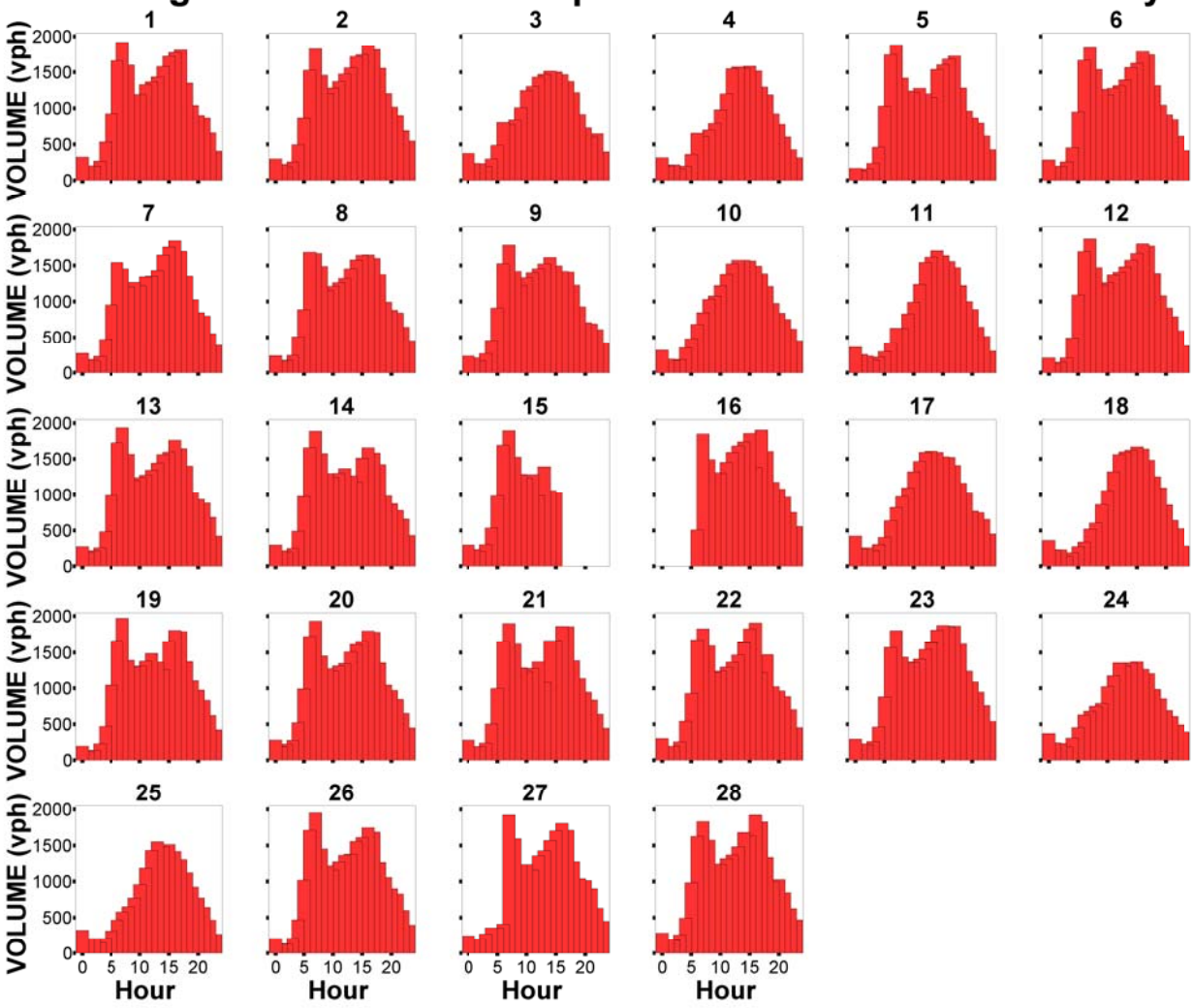
A7 Figure 13. Control Ramp: Detector D Volumes December 2000.



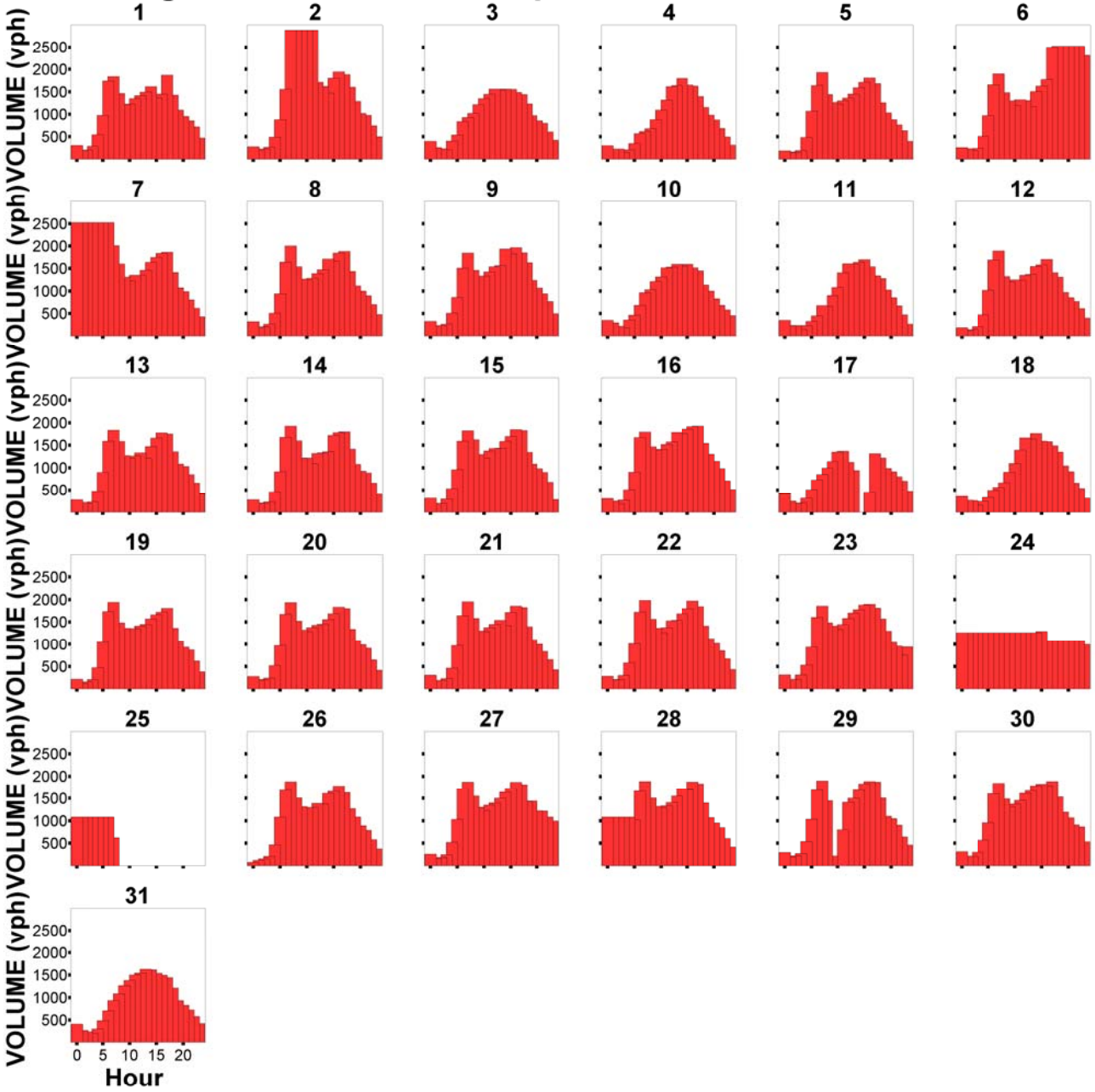
A7 Figure 14. Control Ramp: Detector D Volumes January 2001.



A7 Figure 15. Control Ramp: Detector D Volumes February 2001.

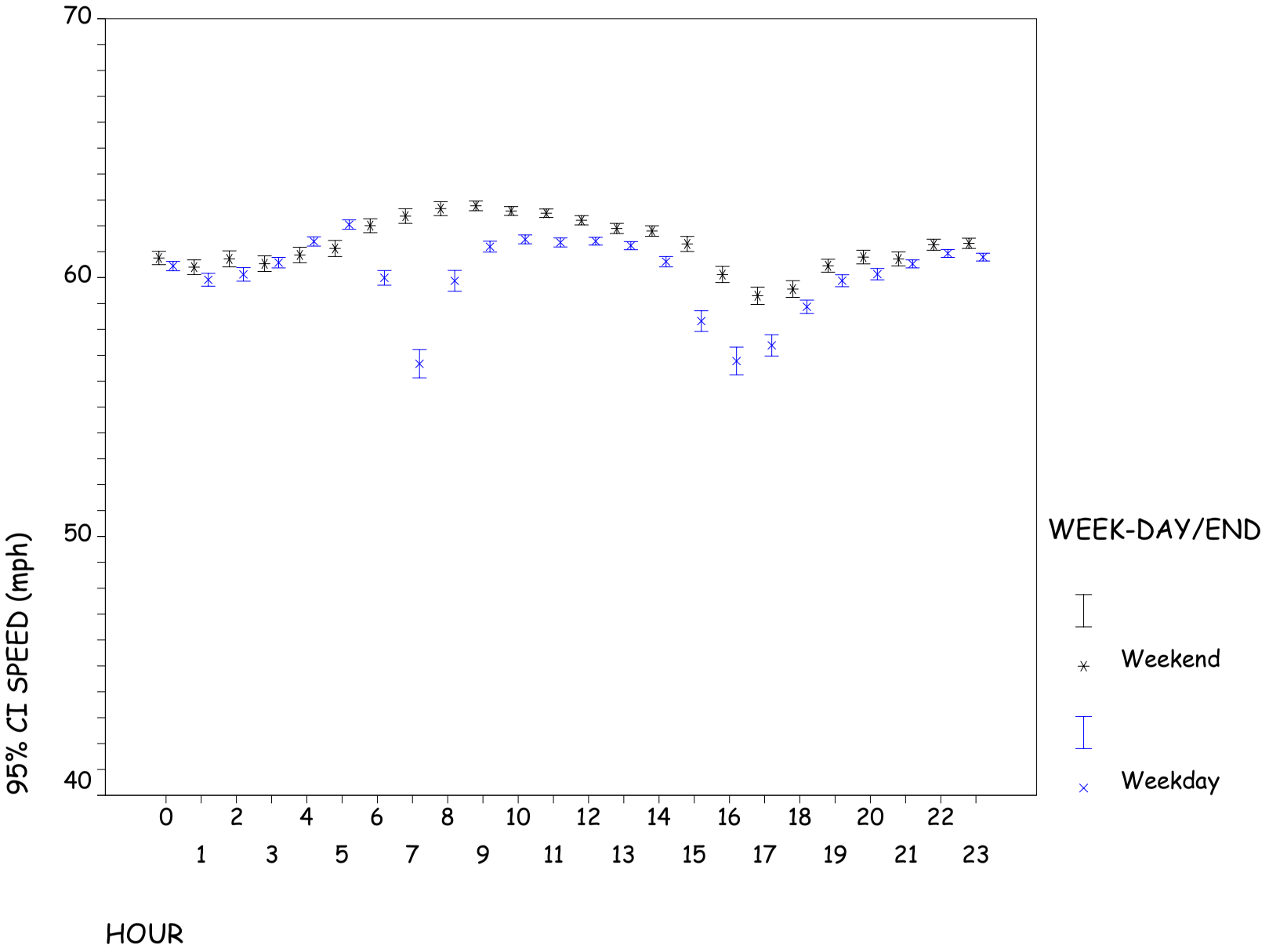


A7 Figure 16. Control Ramp: Detector D Volumes March 2001.

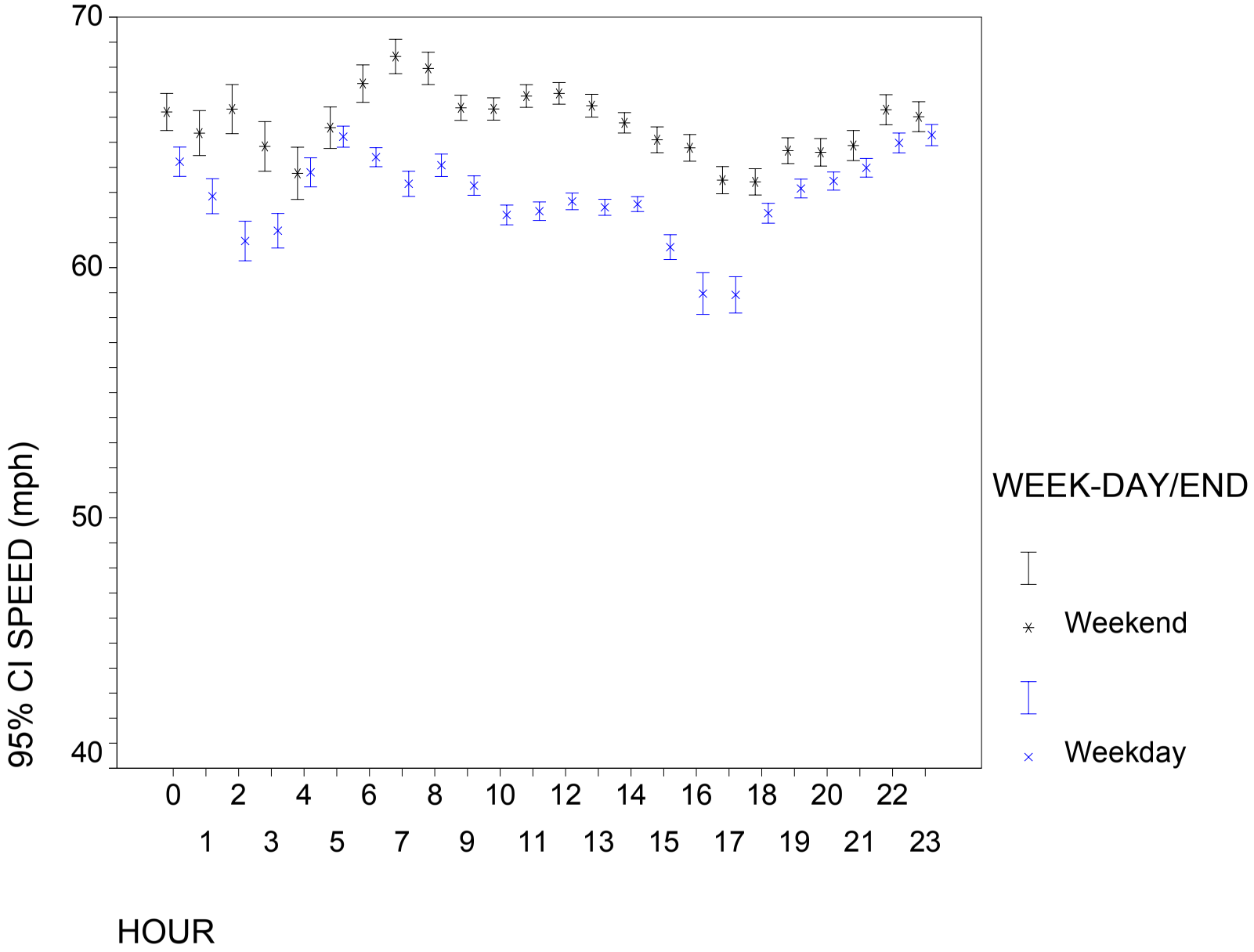


APPENDIX 8
Detector 95% Confidence Intervals for Average Hourly Speeds-Before and After Periods.

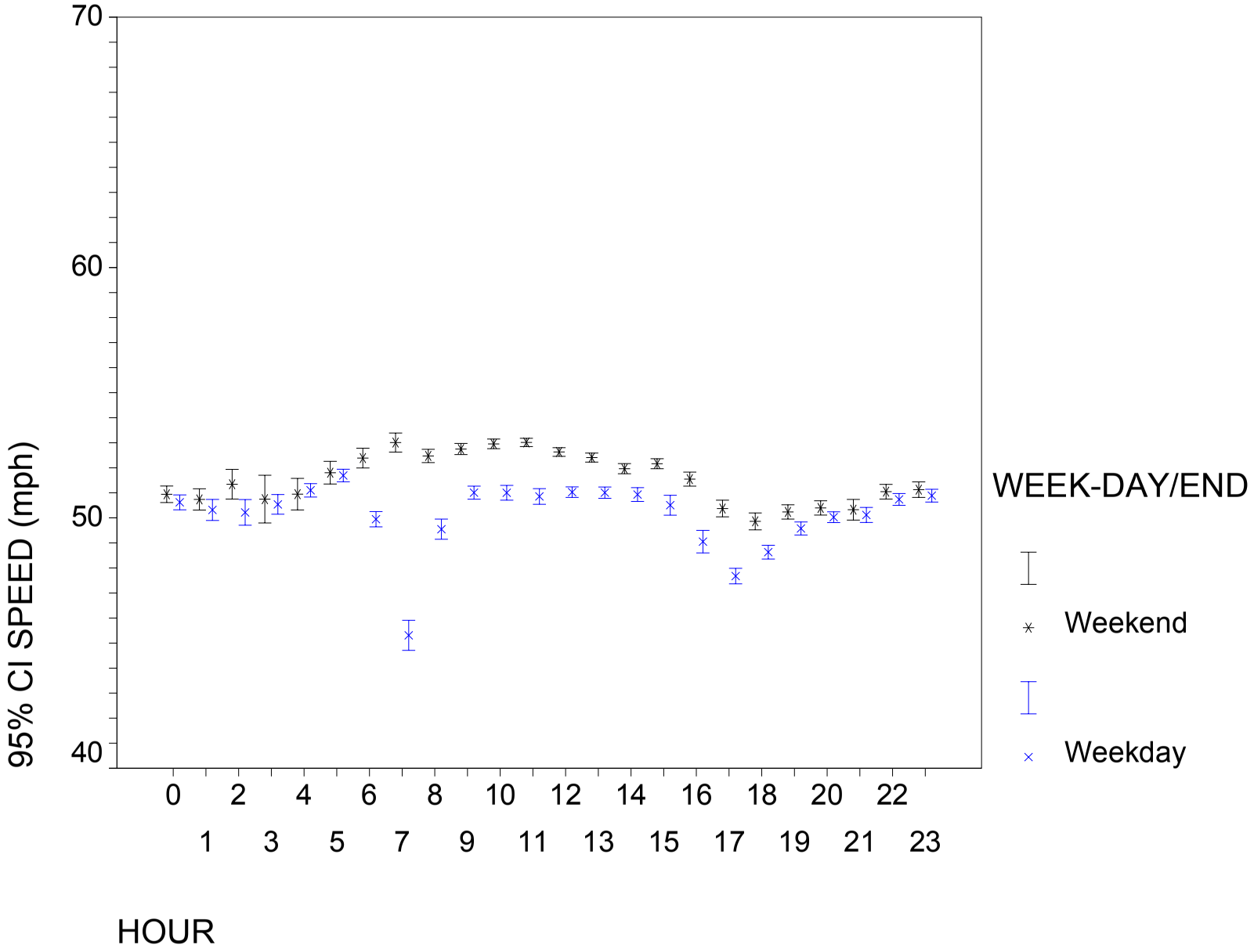
A8 Figure 1. Detector A 95% CI for Average Hourly Speeds-Before



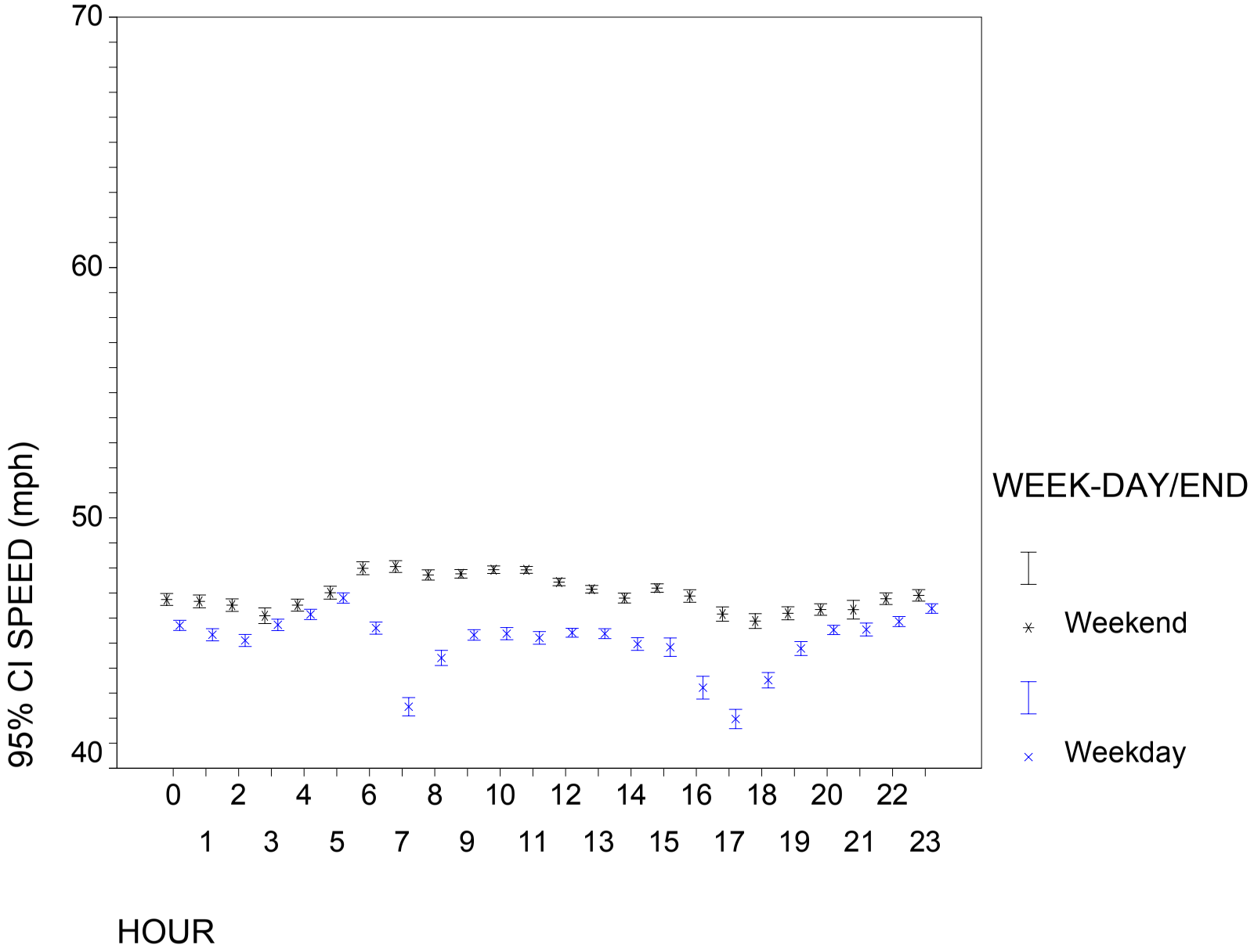
A8 Figure 2. Detector B 95% CI for Average Hourly Speeds-Before



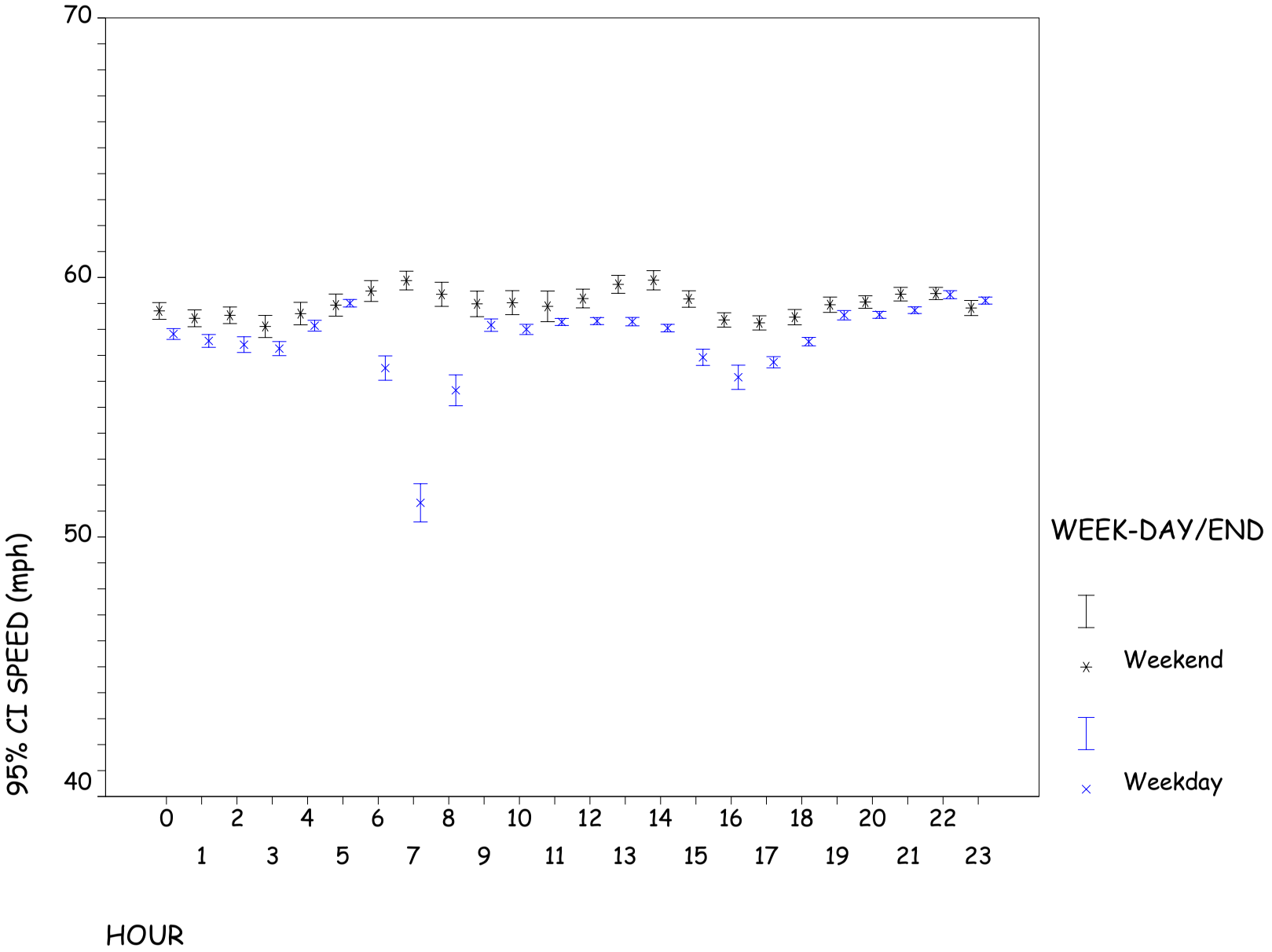
A8 Figure 3. Detector C 95% CI for Average Hourly Speeds-Before



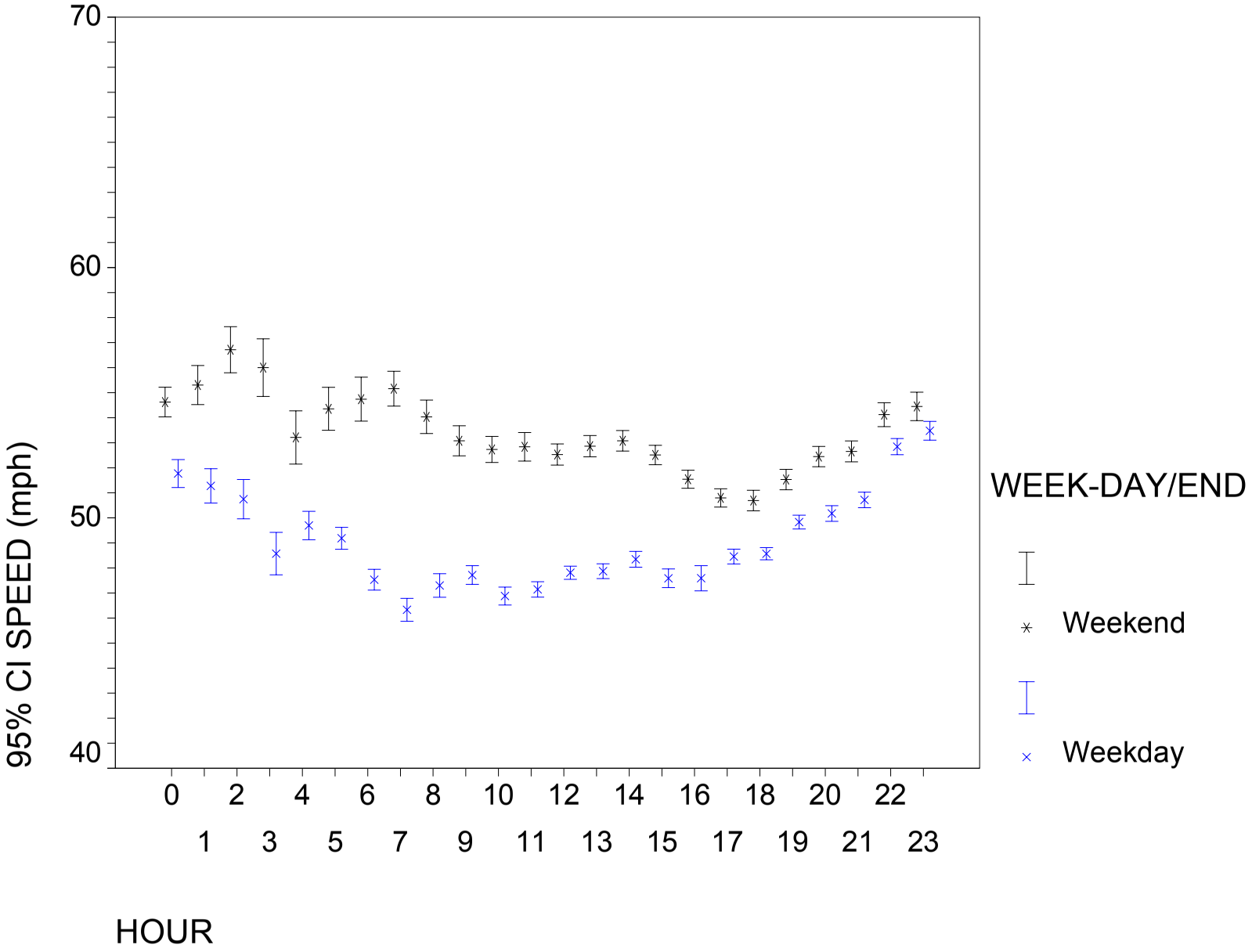
A8 Figure 4. Detector D 95% CI for Average Hourly Speeds-Before



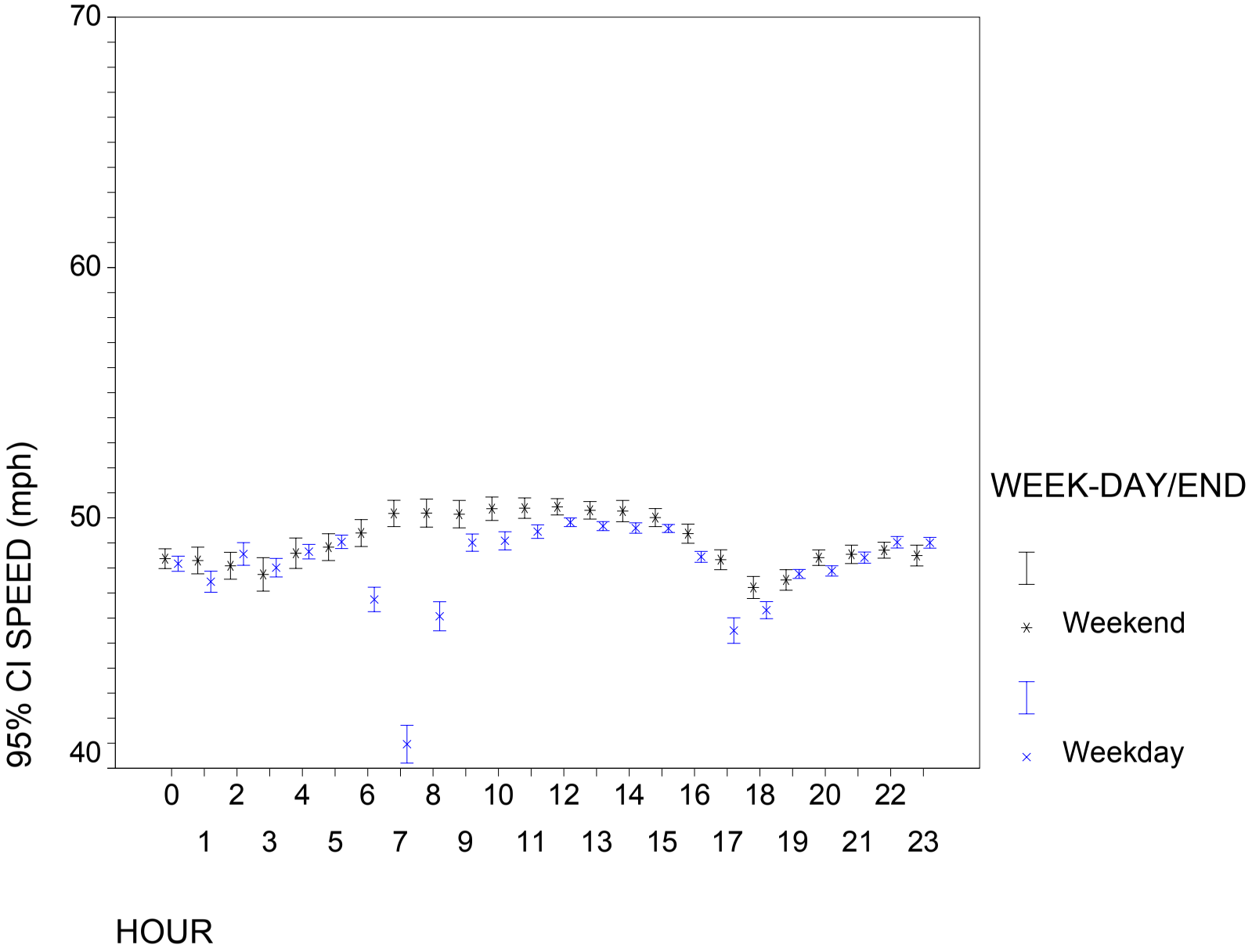
A8 Figure 5. Detector A 95% CI for Average Hourly Speeds-After



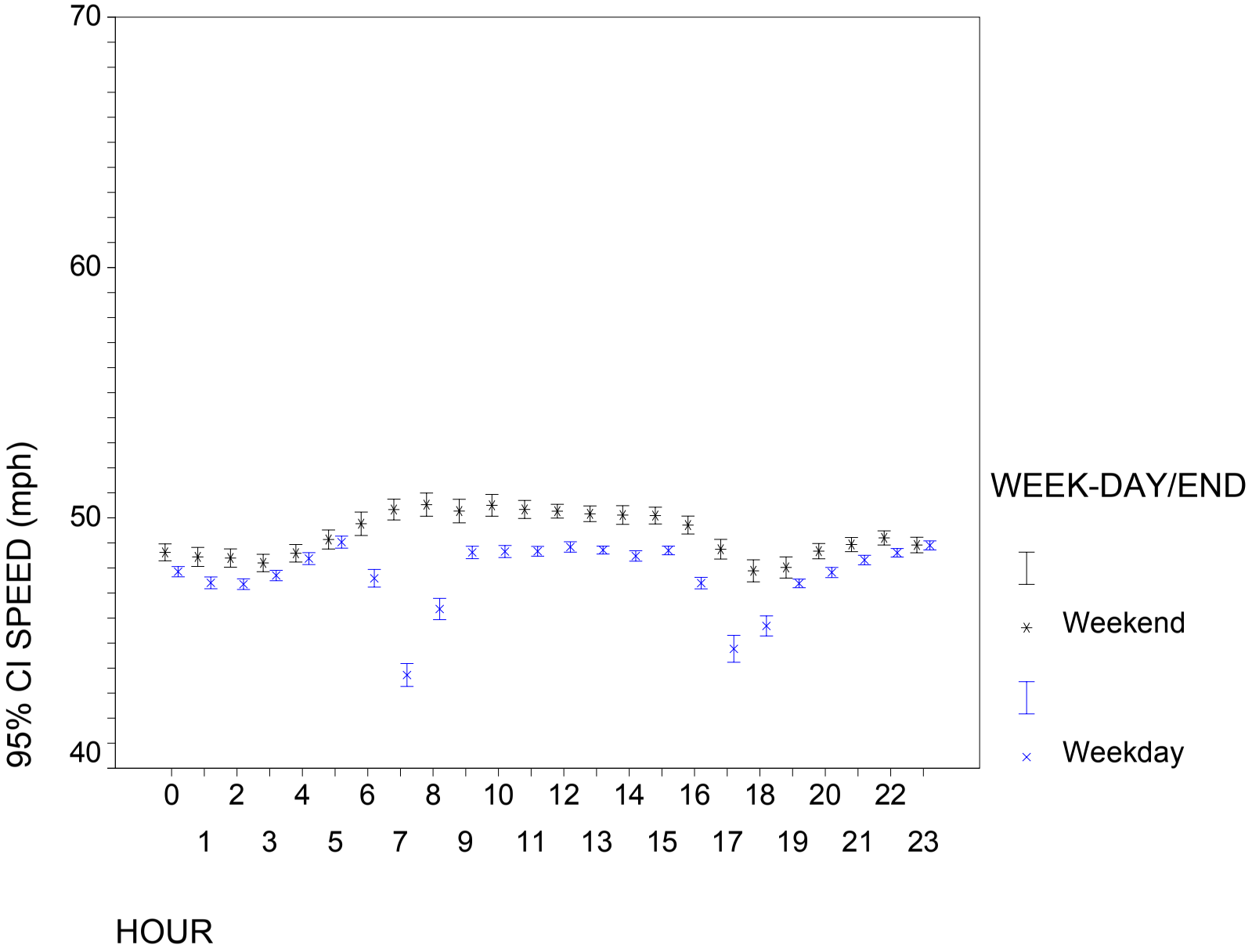
A8 Figure 6. Detector B 95% CI for Average Hourly Speeds-After



A8 Figure 7. Detector C 95% CI for Average Hourly Speeds-After

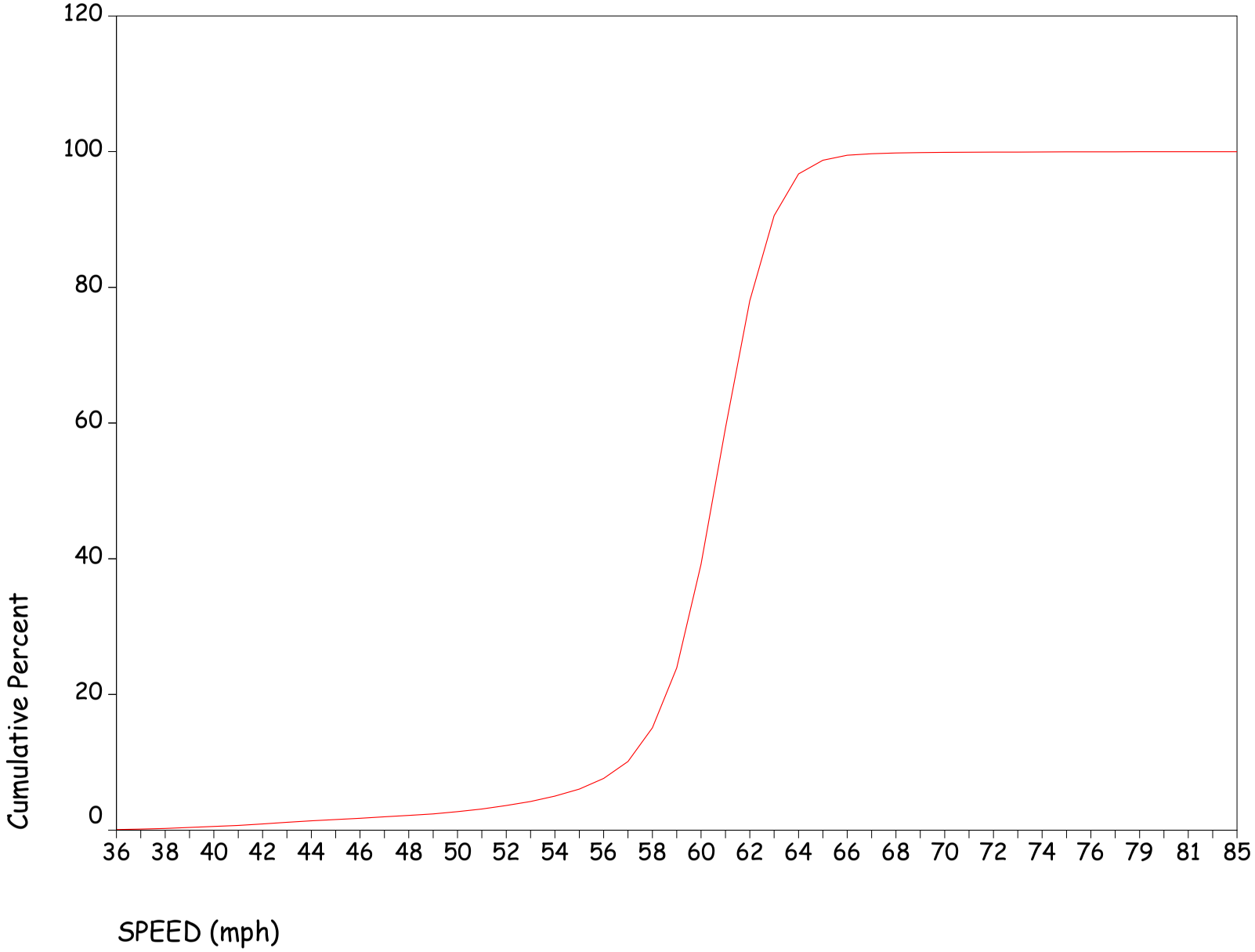


A8 Figure 8. Detector D 95% CI for Average Hourly Speeds-After

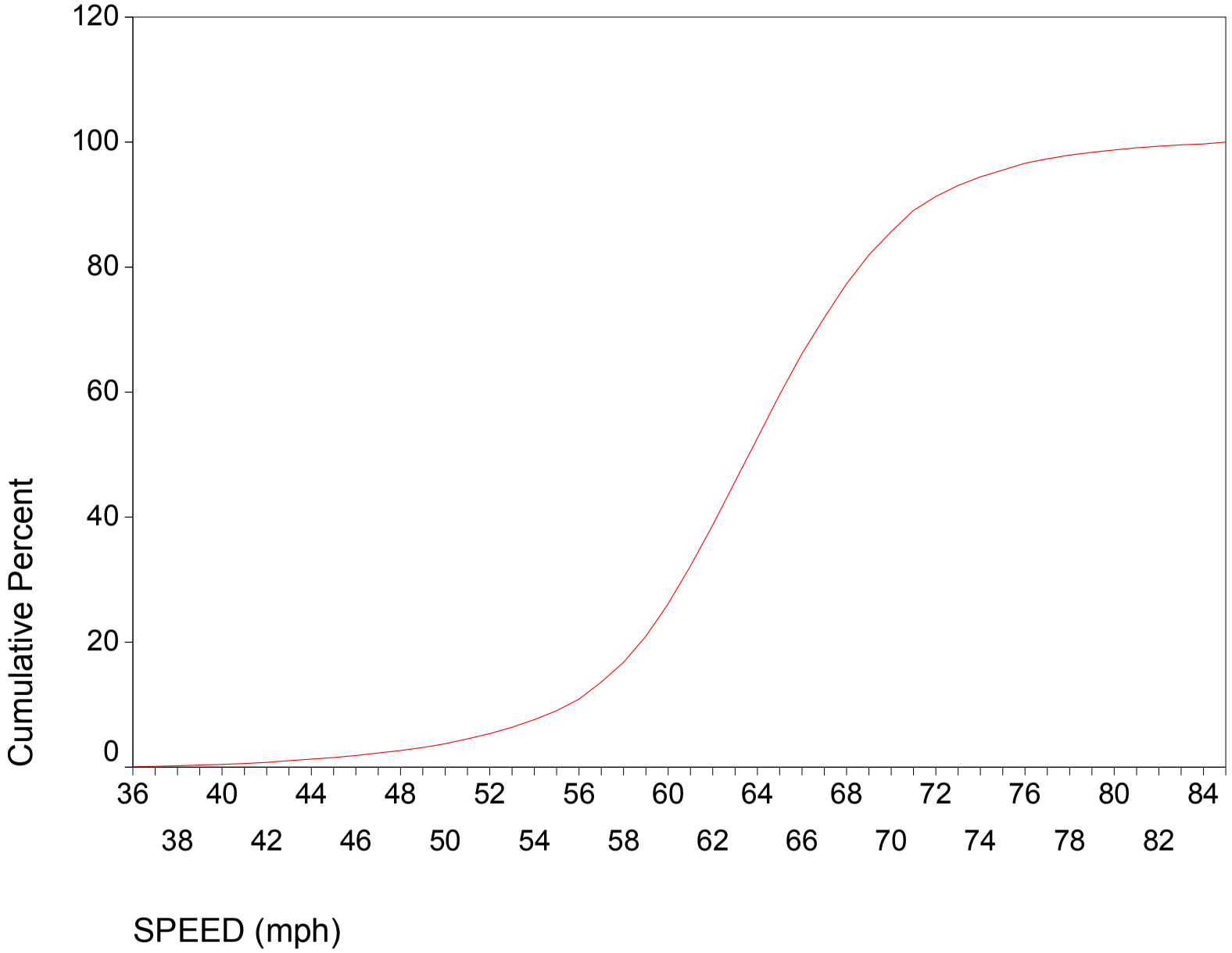


APPENDIX 9
Detector Cumulative Speed Distributions Before and After Periods.

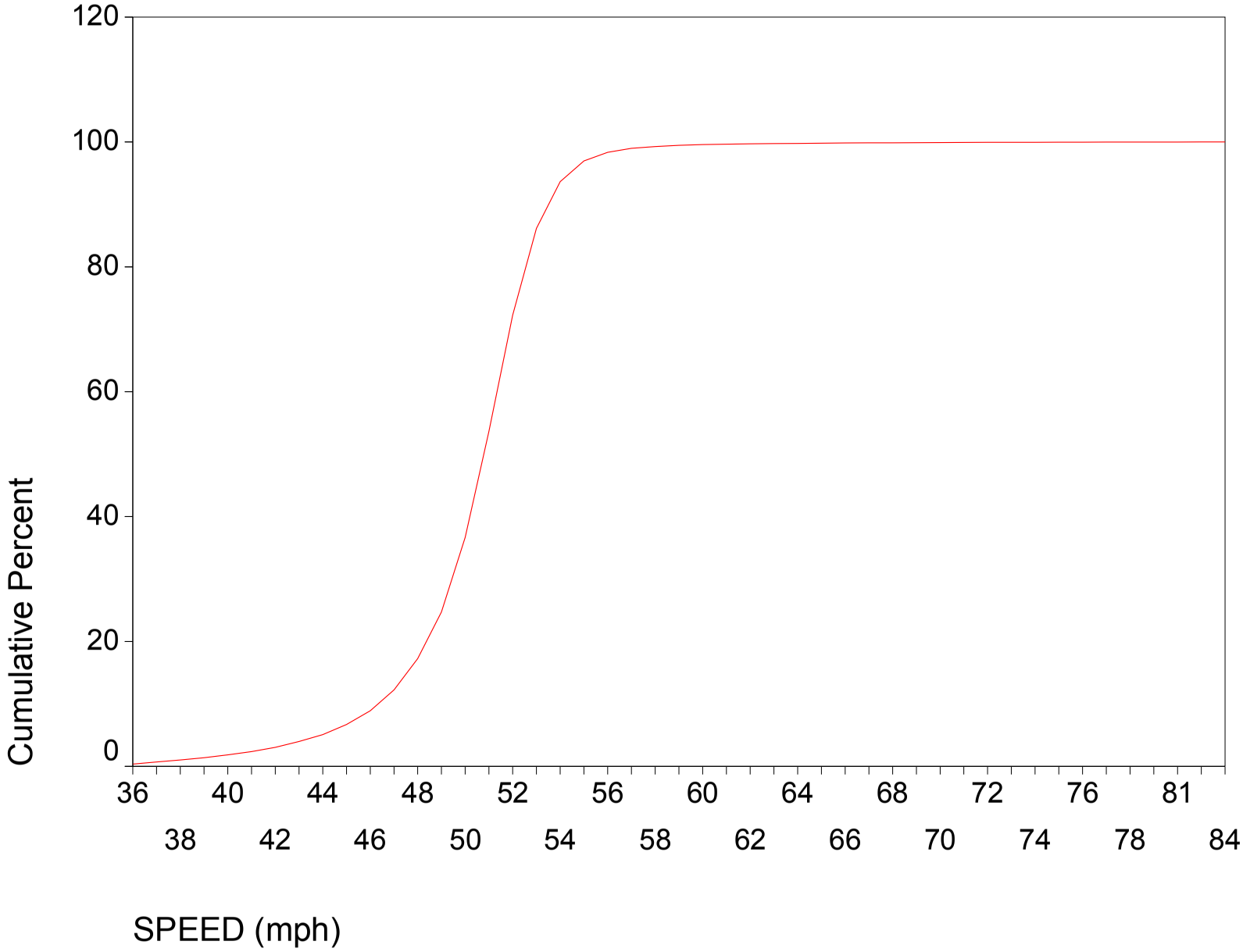
A9 Figure 1. Detector A Cumulative Speed Distribution-Before



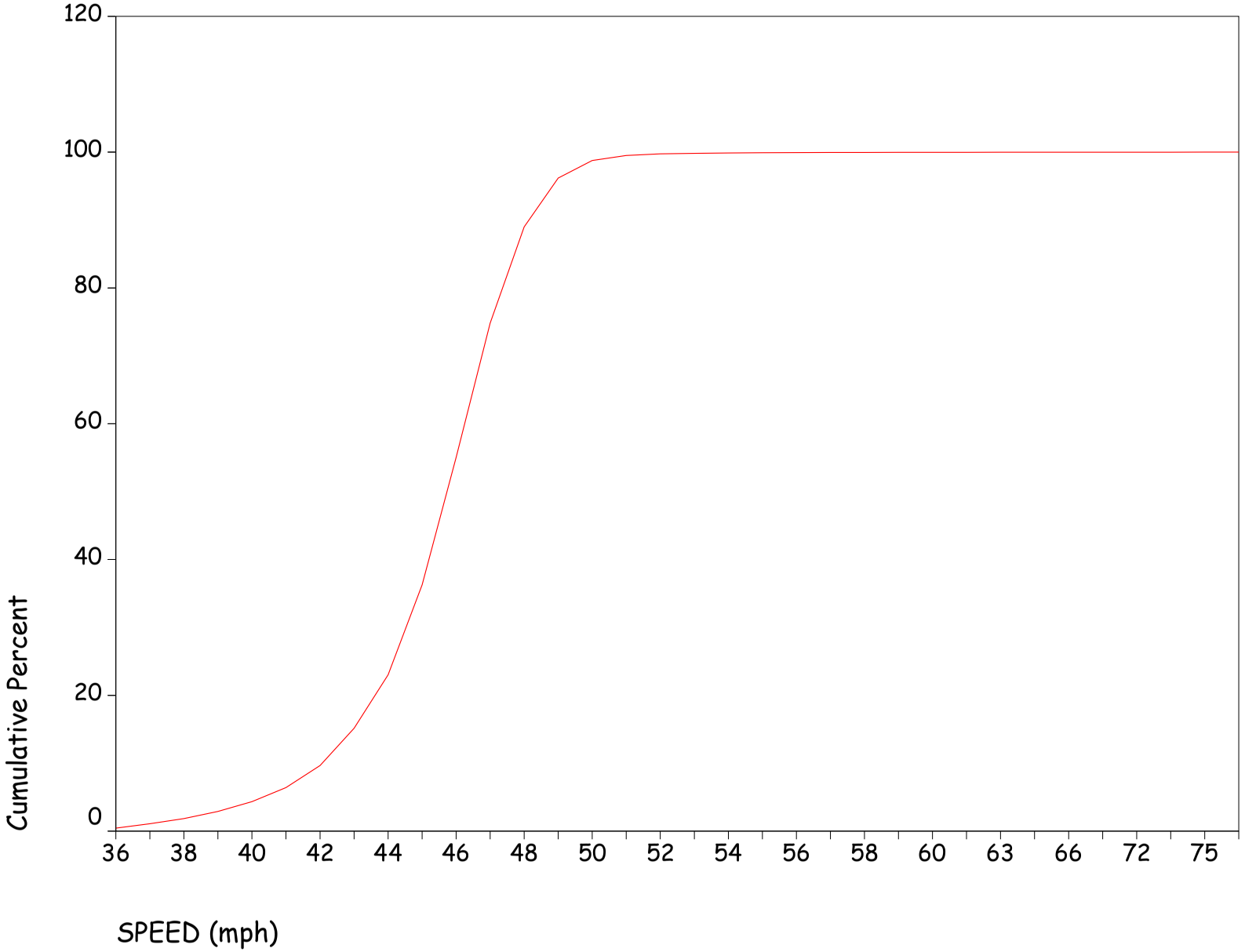
A9 Figure 2. Detector B Cumulative Speed Distribution-Before



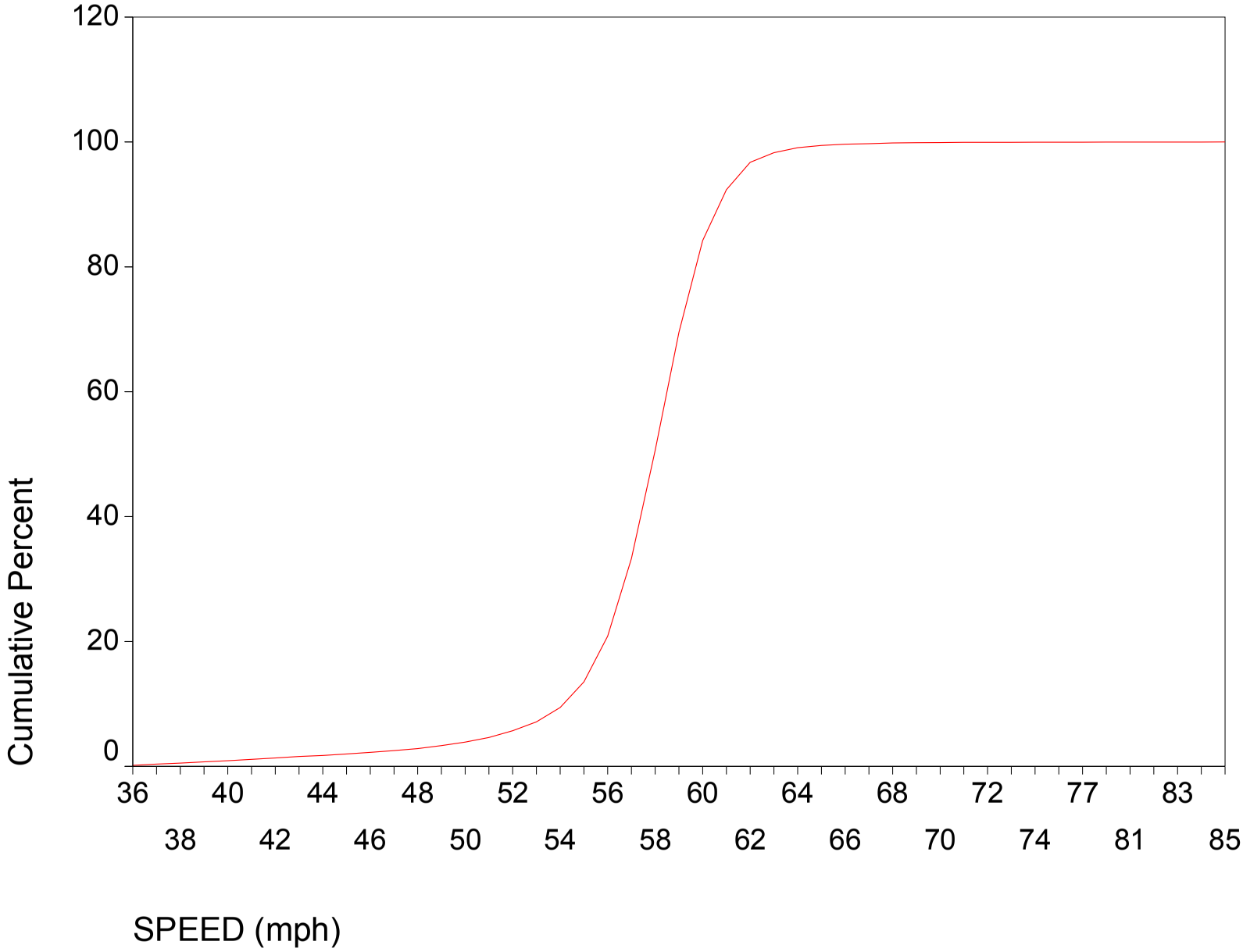
A9 Figure 3. Detector C Cumulative Speed Distribution-Before



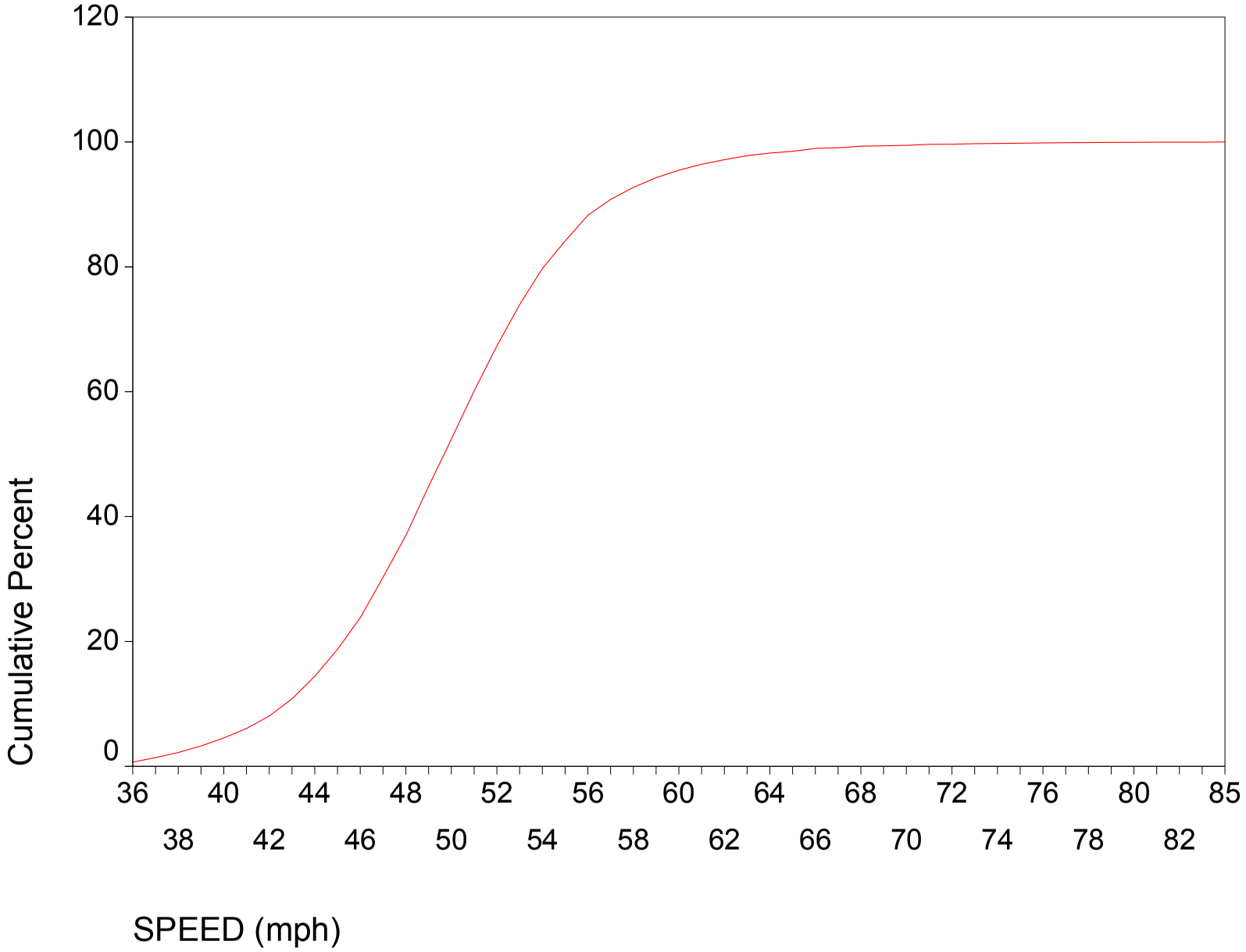
A9 Figure 4. Detector D Cumulative Speed Distribution-Before



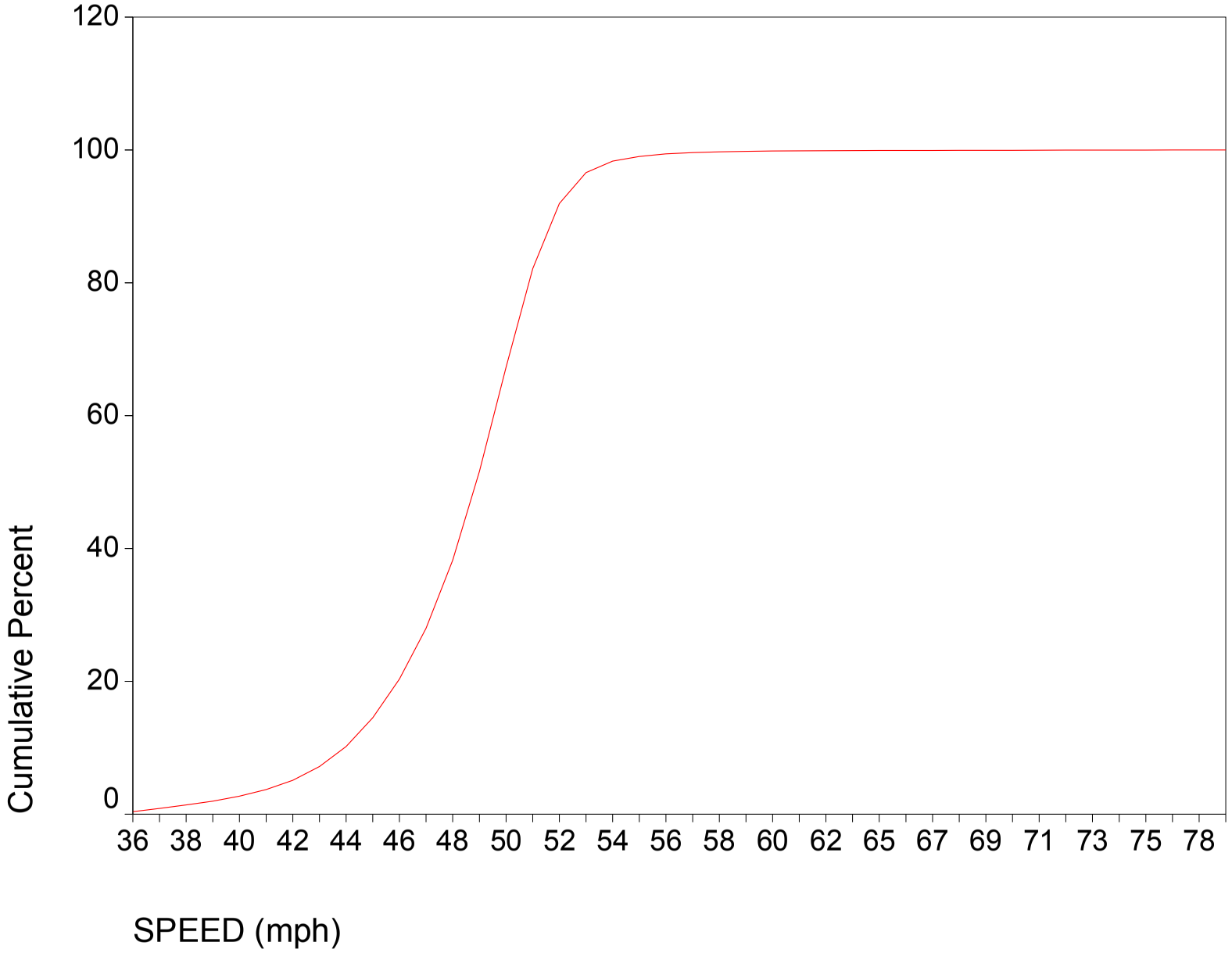
A9 Figure 5. Detector A Cumulative Speed Distribution-After



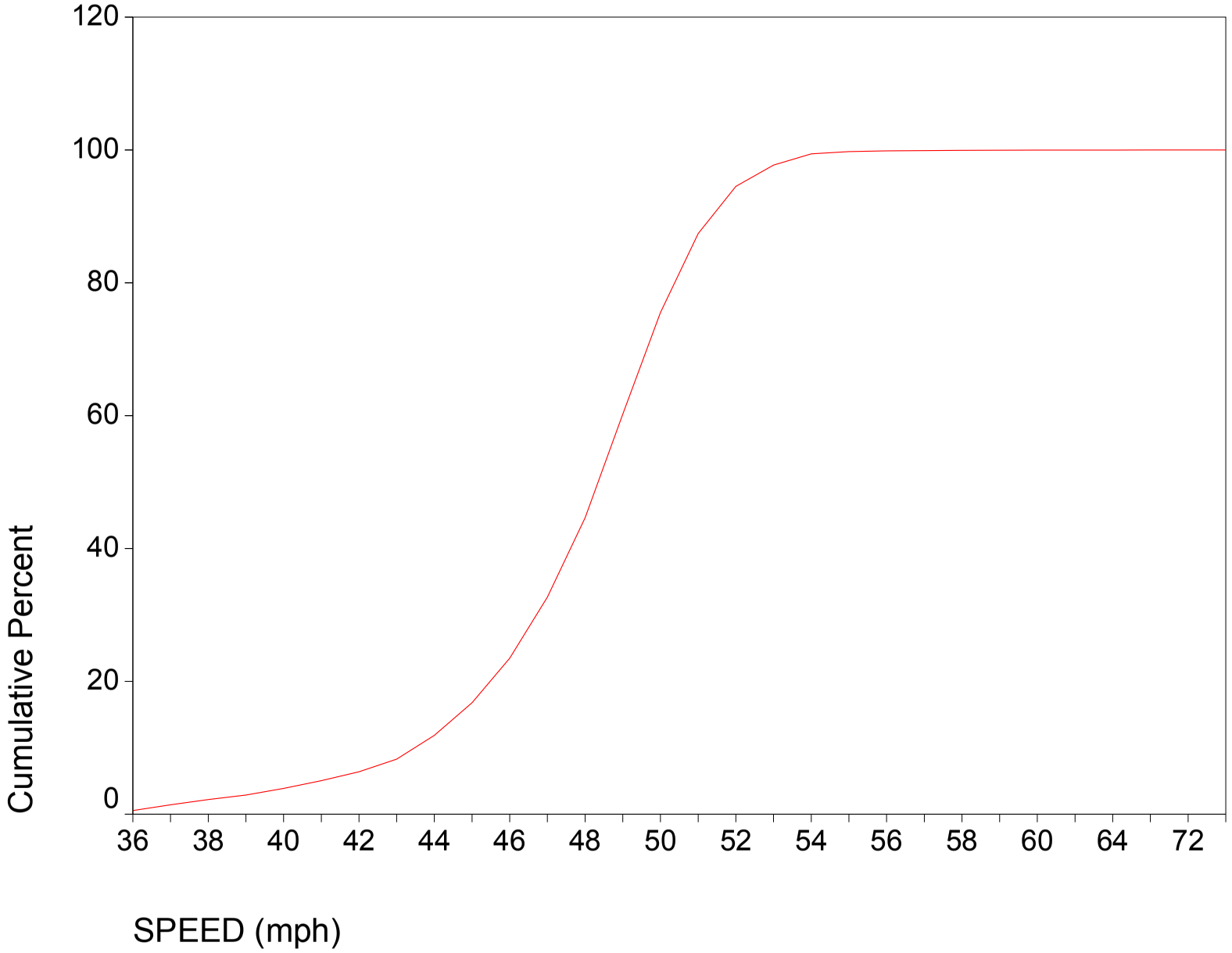
A9 Figure 6. Detector B Cumulative Speed Distribution-After



A9 Figure 7. Detector C Cumulative Speed Distribution-After

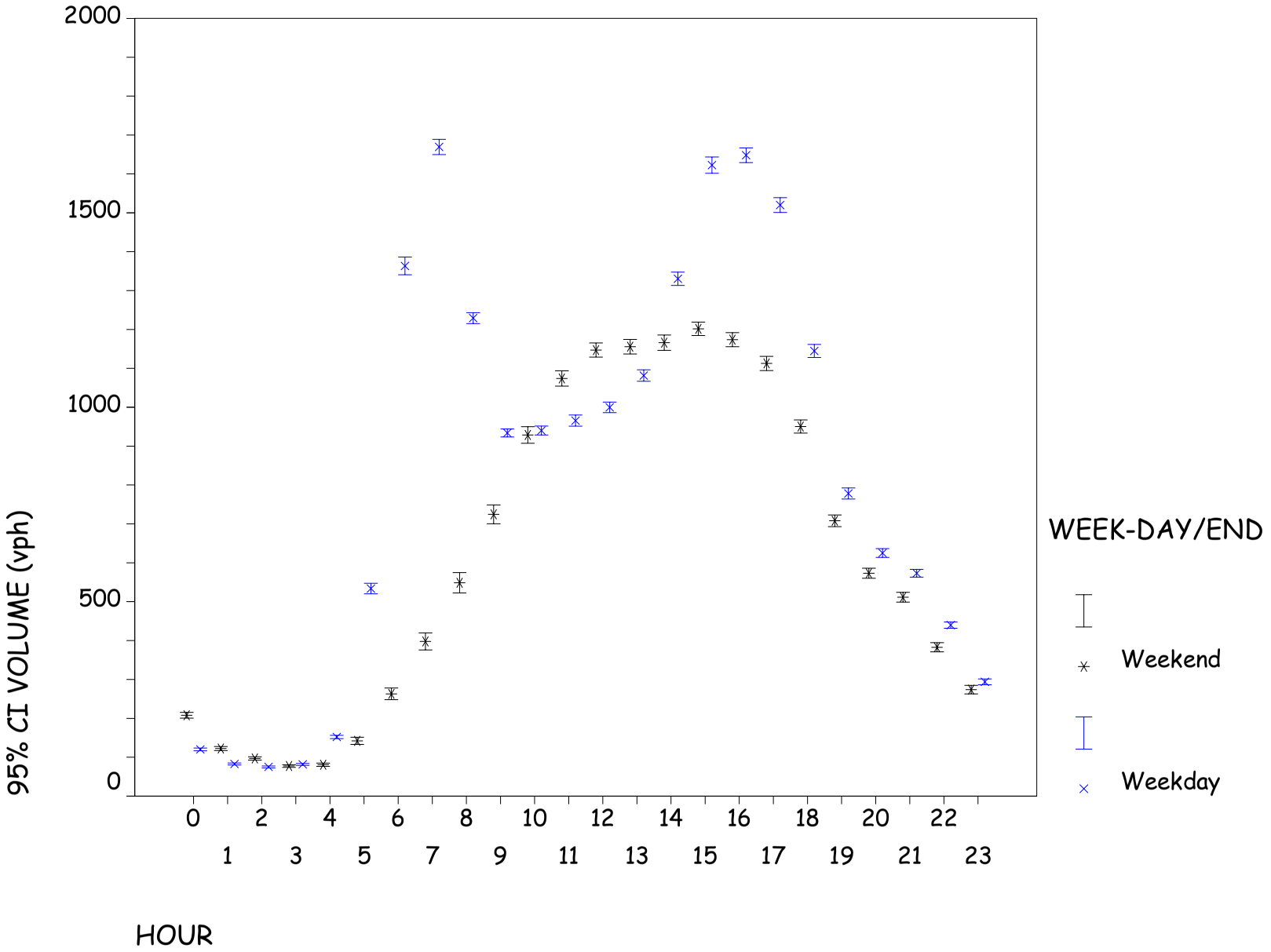


A9 Figure 8. Detector D Cumulative Speed Distribution-After

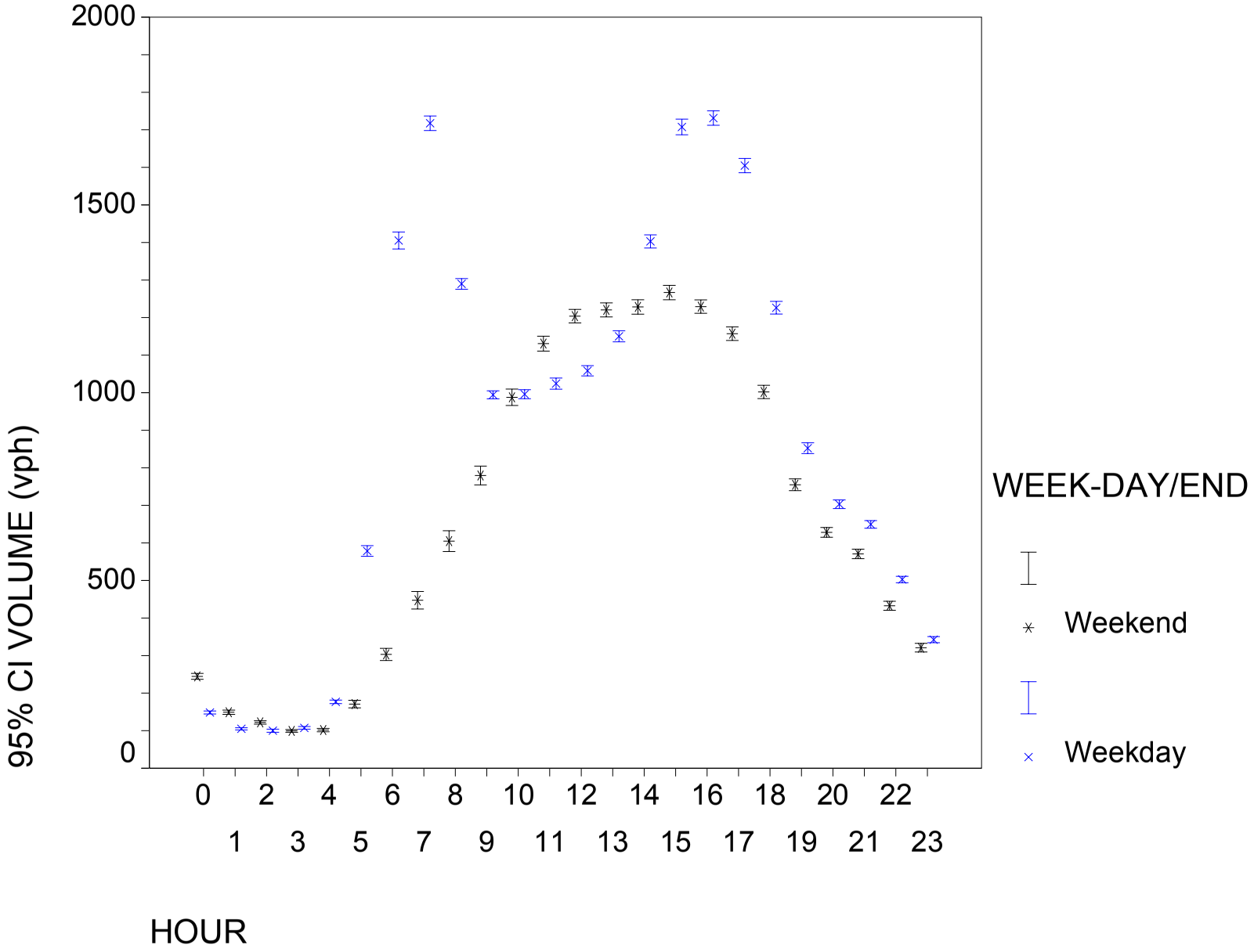


APPENDIX 10
Detector 95% Confidence Intervals for Average Hourly Volumes-Before and After Periods.

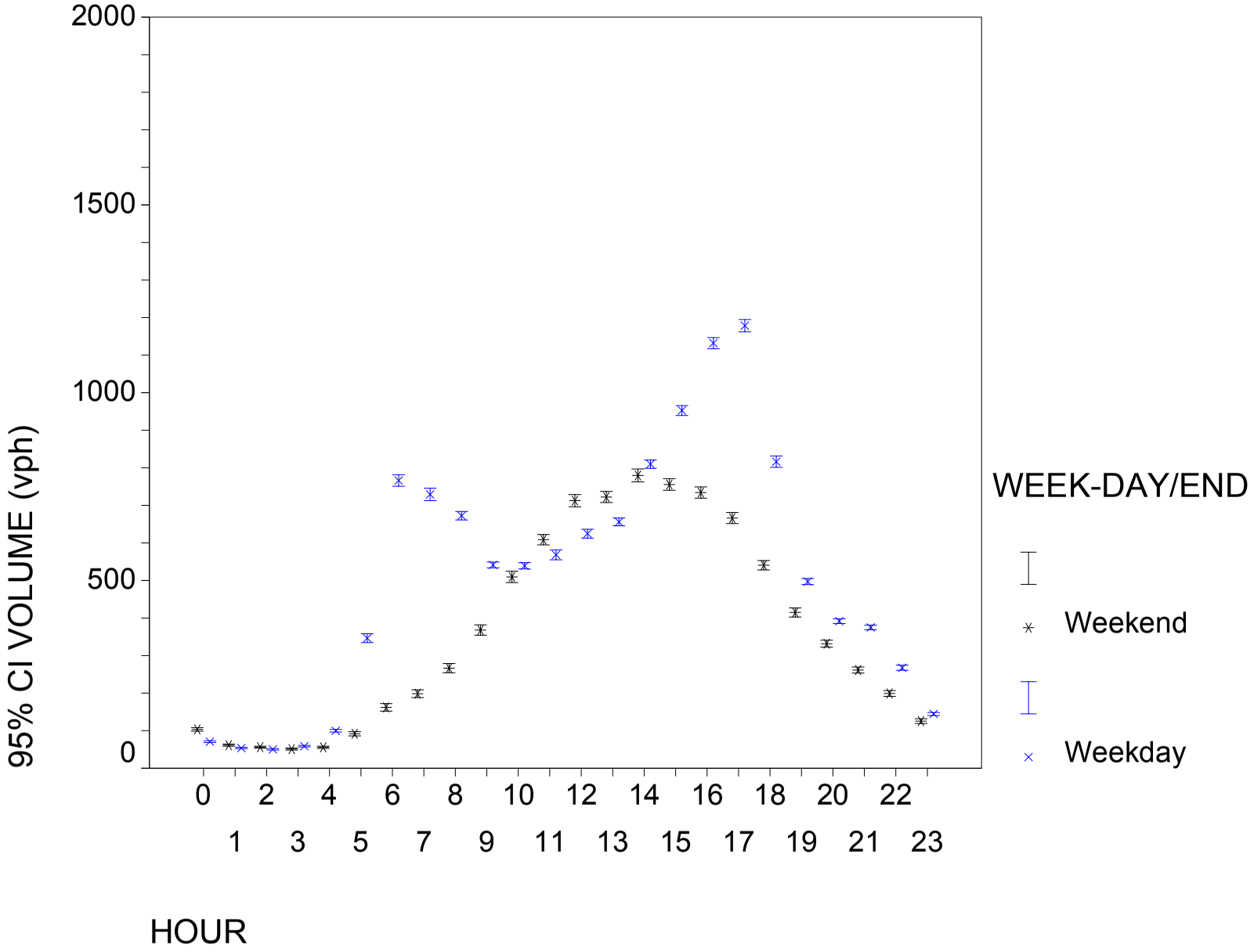
A10 Figure 1. Detector A 95% CI-Average Hourly Volumes-Before



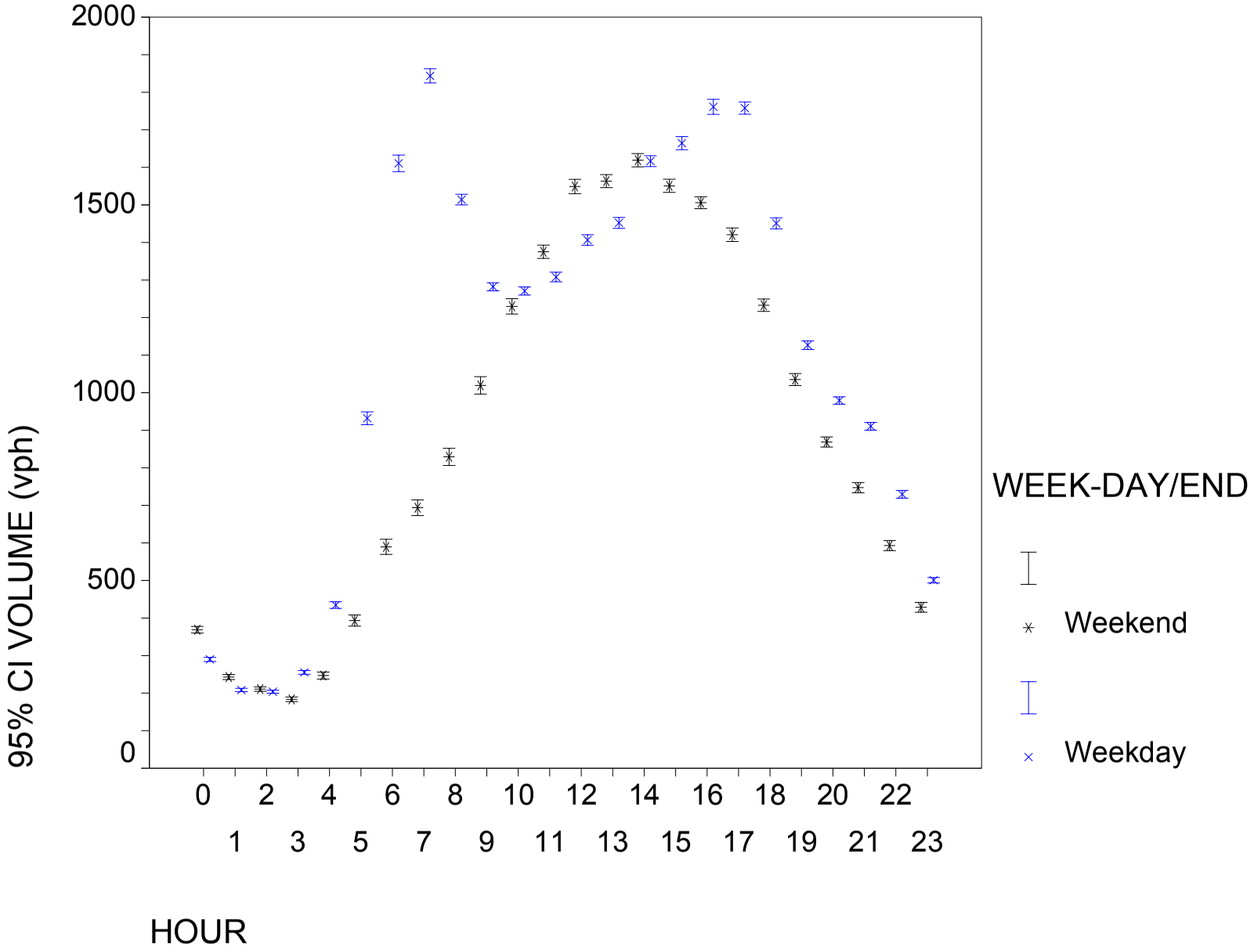
A10 Figure 2. Detector B 95% CI-Average Hourly Volumes-Before



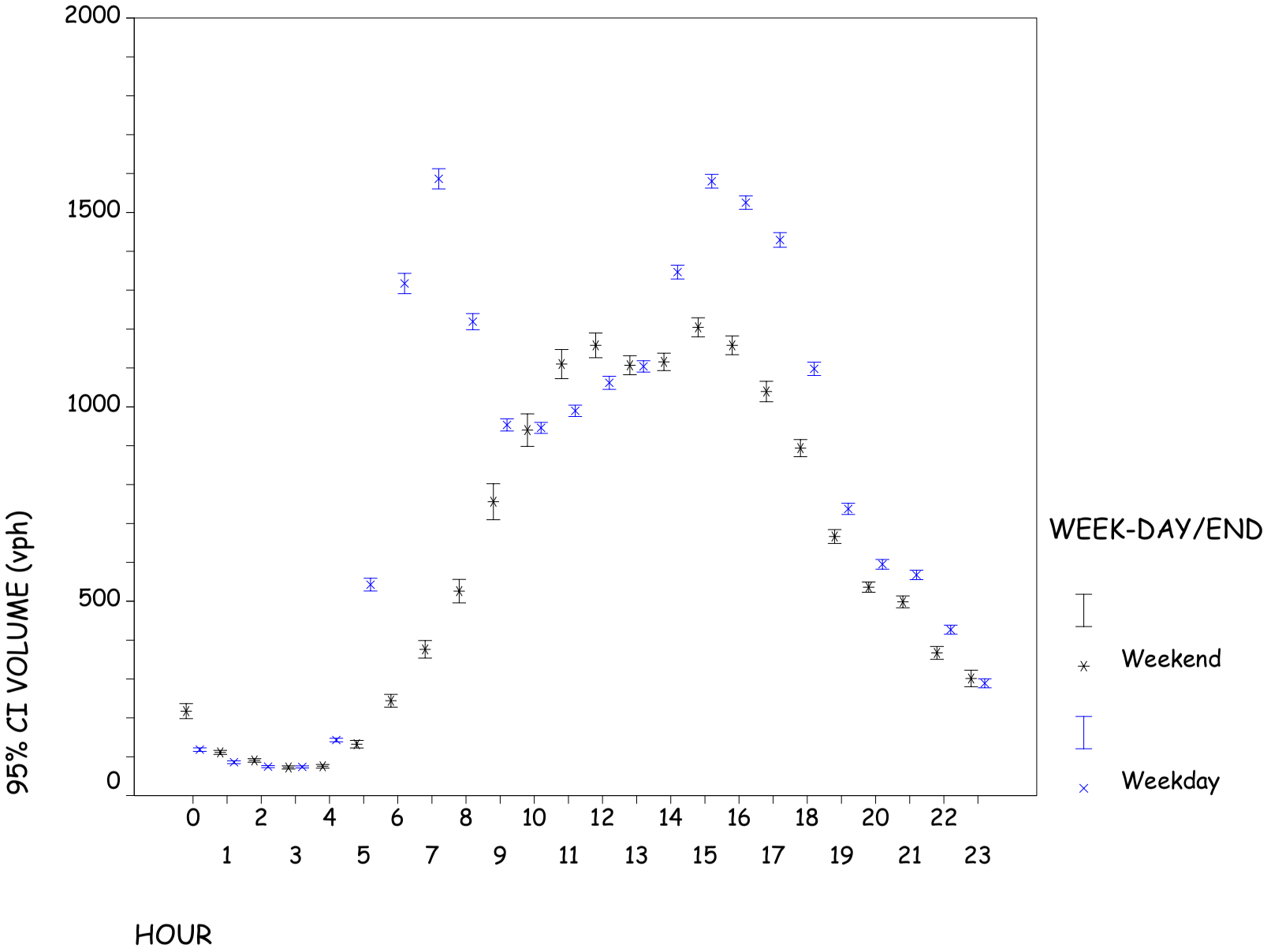
A10 Figure 3. Detector C 95% CI-Average Hourly Volumes-Before



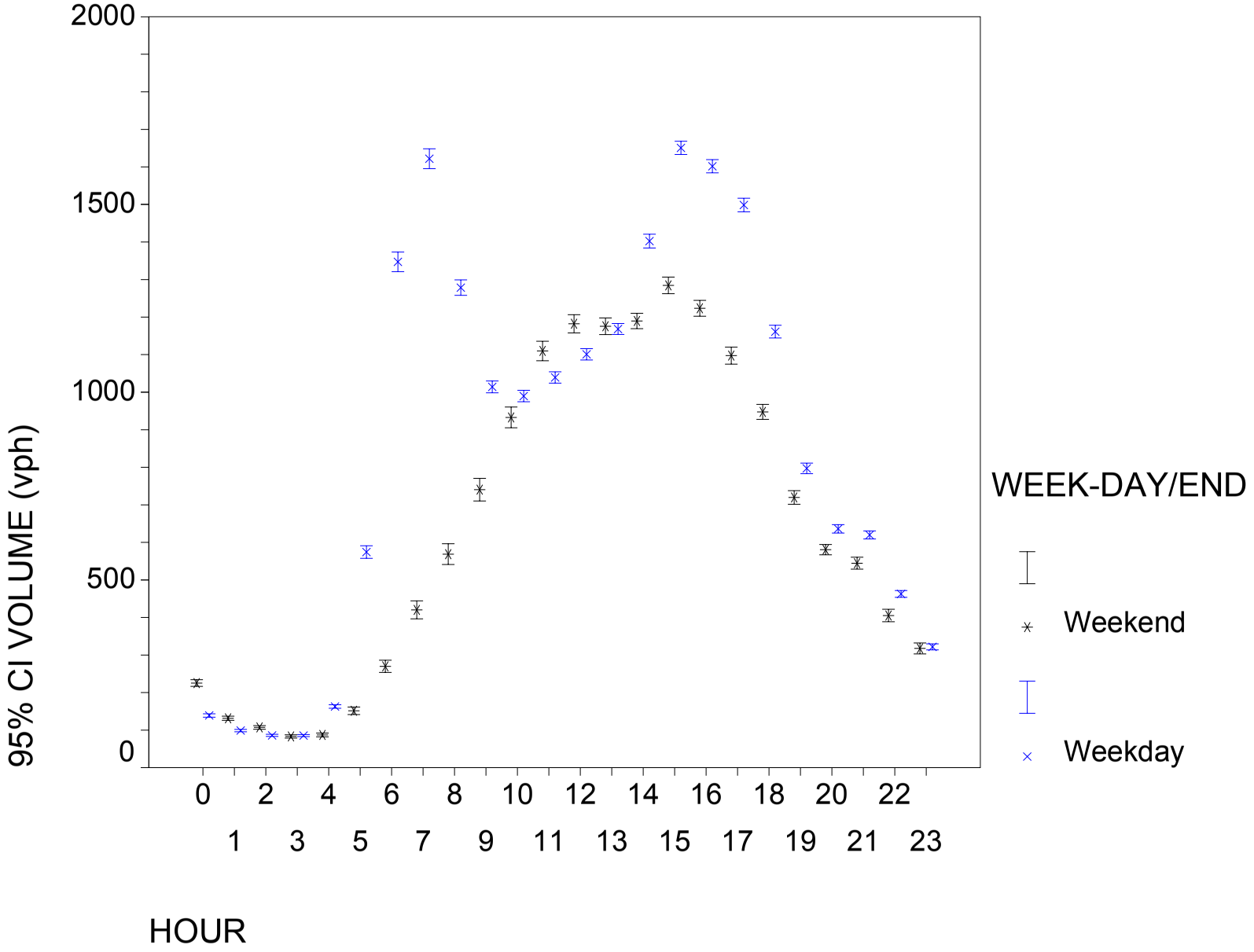
A10 Figure 4. Detector D 95% CI-Average Hourly Volumes-Before



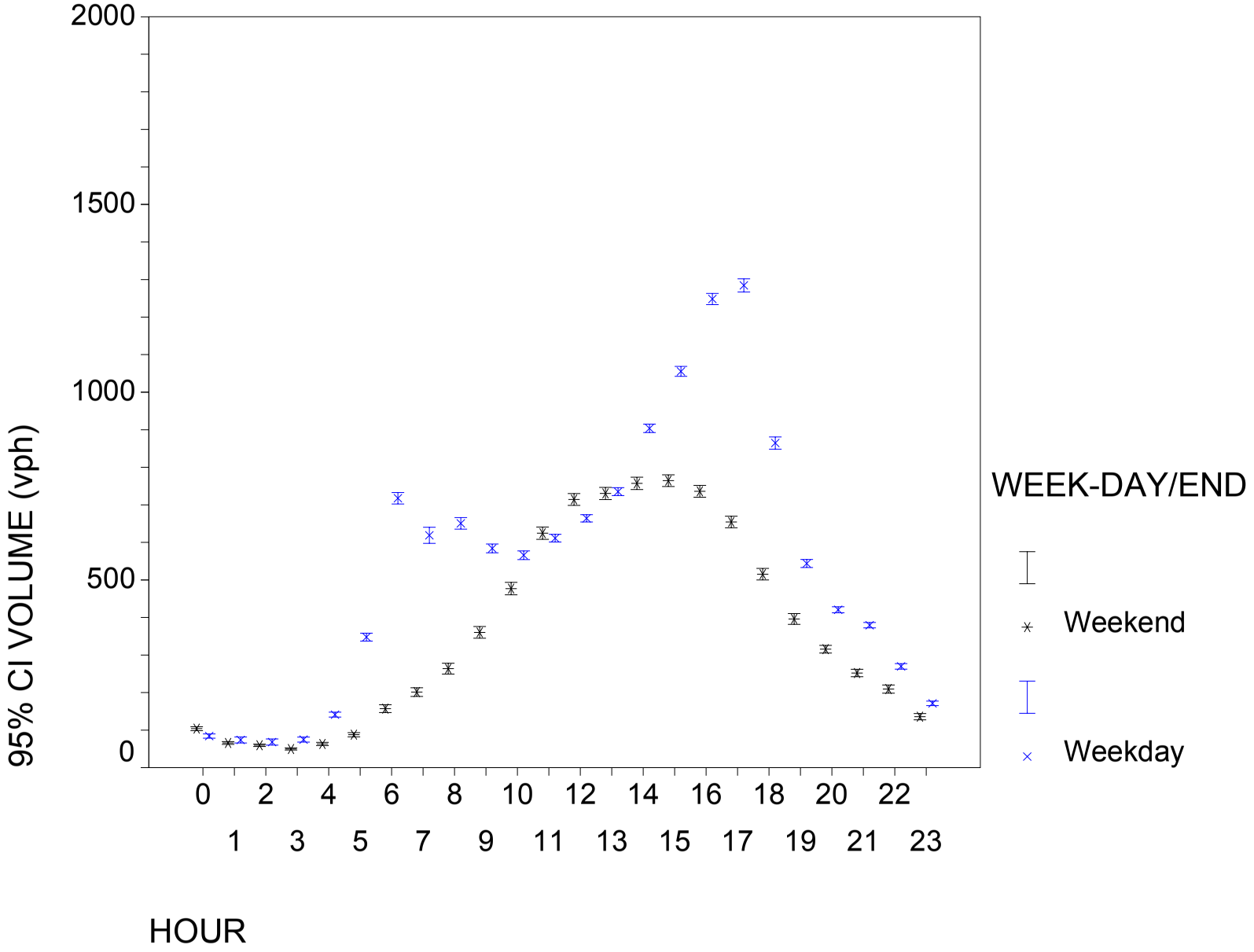
A10 Figure 5. Detector A 95% CI-Average Hourly Volumes-After



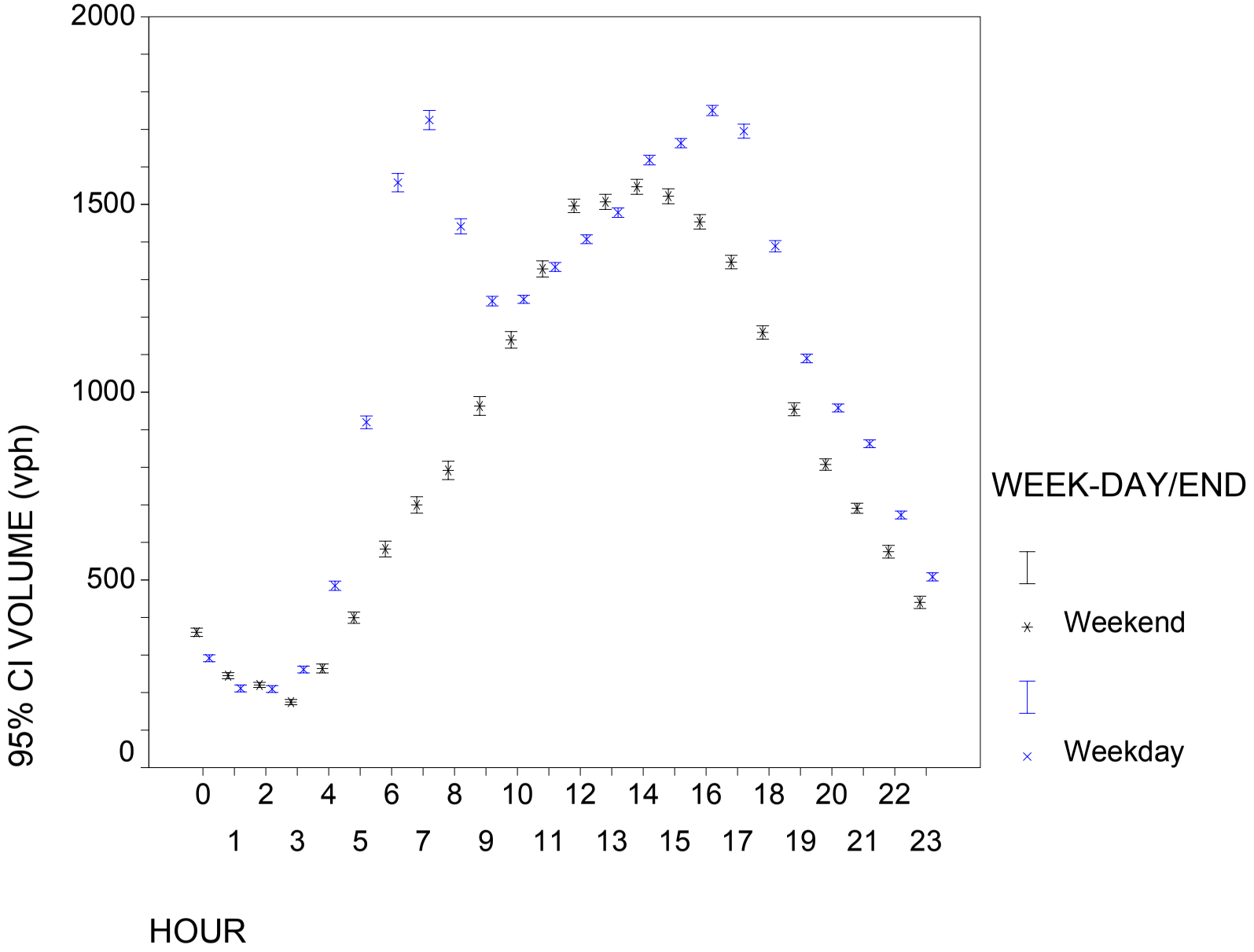
A10 Figure 6. Detector B 95% CI-Average Hourly Volumes-After



A10 Figure 7. Detector C 95% CI-Average Hourly Volumes-After



A10 Figure 8. Detector D 95% CI-Average Hourly Volumes-After



APPENDIX 11
Detector Speed and Volume Statistics for Weekdays and Weekends
Before and After Periods

A11 Table 1. Detector A Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector A

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	60	0	N=853	60	0	N=288
		VOLUME (vph)	117	2	N=853	205	5	N=288
	1	SPEED (mph)	60	0	N=685	60	0	N=256
		VOLUME (vph)	82	1	N=685	119	3	N=256
	2	SPEED (mph)	60	0	N=657	60	0	N=242
		VOLUME (vph)	74	1	N=657	96	3	N=242
	3	SPEED (mph)	60	0	N=775	60	0	N=246
		VOLUME (vph)	80	1	N=775	74	2	N=246
	4	SPEED (mph)	61	0	N=836	61	0	N=242
		VOLUME (vph)	147	2	N=836	78	2	N=242
	5	SPEED (mph)	62	0	N=819	61	0	N=272
		VOLUME (vph)	522	6	N=819	141	5	N=272
	6	SPEED (mph)	59	0	N=857	61	0	N=287
		VOLUME (vph)	1365	11	N=857	261	8	N=287
	7	SPEED (mph)	57	0	N=839	62	0	N=288
		VOLUME (vph)	1681	8	N=839	391	12	N=288
	8	SPEED (mph)	60	0	N=870	62	0	N=288
		VOLUME (vph)	1214	7	N=870	529	14	N=288
	9	SPEED (mph)	61	0	N=850	62	0	N=288
		VOLUME (vph)	909	5	N=850	697	14	N=288
	10	SPEED (mph)	61	0	N=856	62	0	N=281
		VOLUME (vph)	900	5	N=856	886	13	N=281
	11	SPEED (mph)	61	0	N=862	62	0	N=281
		VOLUME (vph)	916	7	N=862	1032	12	N=281
	12	SPEED (mph)	61	0	N=889	62	0	N=294
		VOLUME (vph)	956	6	N=889	1116	11	N=294
	13	SPEED (mph)	61	0	N=844	62	0	N=296
		VOLUME (vph)	1036	7	N=844	1124	11	N=296
	14	SPEED (mph)	60	0	N=894	62	0	N=288
		VOLUME (vph)	1301	8	N=894	1128	11	N=288
	15	SPEED (mph)	59	0	N=883	61	0	N=296
		VOLUME (vph)	1592	10	N=883	1183	10	N=296
	16	SPEED (mph)	58	0	N=863	60	0	N=305
		VOLUME (vph)	1629	9	N=863	1155	10	N=305
	17	SPEED (mph)	58	0	N=903	59	0	N=312
		VOLUME (vph)	1514	9	N=903	1076	11	N=312

A11 Table 1. Detector A Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector A

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	59	0	N=896	59	0	N=312
		VOLUME (vph)	1112	8	N=896	914	10	N=312
	19	SPEED (mph)	59	0	N=914	60	0	N=312
		VOLUME (vph)	742	7	N=914	662	9	N=312
	20	SPEED (mph)	59	0	N=930	60	0	N=312
		VOLUME (vph)	592	5	N=930	541	7	N=312
	21	SPEED (mph)	60	0	N=940	60	0	N=312
		VOLUME (vph)	549	5	N=940	489	7	N=312
	22	SPEED (mph)	60	0	N=951	61	0	N=312
		VOLUME (vph)	422	4	N=951	372	7	N=312
	23	SPEED (mph)	60	0	N=954	61	0	N=312
		VOLUME (vph)	281	4	N=954	271	6	N=312
Table Total		SPEED (mph)	60	0	N=20620	61	0	N=6922
		VOLUME (vph)	837	4	N=20620	622	5	N=6922

A11 Table 2. Detector B Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector B

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	64	0	N=851	66	0	N=284
		VOLUME (vph)	145	2	N=851	246	5	N=284
	1	SPEED (mph)	63	0	N=730	66	1	N=255
		VOLUME (vph)	104	1	N=730	147	3	N=255
	2	SPEED (mph)	62	0	N=707	66	1	N=242
		VOLUME (vph)	98	2	N=707	121	3	N=242
	3	SPEED (mph)	62	0	N=797	65	1	N=272
		VOLUME (vph)	104	2	N=797	97	2	N=272
	4	SPEED (mph)	64	0	N=827	64	1	N=275
		VOLUME (vph)	170	2	N=827	99	3	N=275
	5	SPEED (mph)	65	0	N=824	66	0	N=270
		VOLUME (vph)	568	7	N=824	172	6	N=270
	6	SPEED (mph)	64	0	N=861	67	0	N=279
		VOLUME (vph)	1406	10	N=861	303	9	N=279
	7	SPEED (mph)	63	0	N=878	68	0	N=282
		VOLUME (vph)	1720	8	N=878	442	12	N=282
	8	SPEED (mph)	64	0	N=888	68	0	N=286
		VOLUME (vph)	1277	7	N=888	586	15	N=286
	9	SPEED (mph)	63	0	N=854	66	0	N=288
		VOLUME (vph)	973	5	N=854	755	14	N=288
	10	SPEED (mph)	62	0	N=852	66	0	N=281
		VOLUME (vph)	958	5	N=852	947	13	N=281
	11	SPEED (mph)	63	0	N=854	67	0	N=281
		VOLUME (vph)	982	7	N=854	1090	12	N=281
	12	SPEED (mph)	63	0	N=888	68	0	N=294
		VOLUME (vph)	1016	7	N=888	1174	11	N=294
	13	SPEED (mph)	63	0	N=845	67	0	N=299
		VOLUME (vph)	1107	7	N=845	1190	11	N=299
	14	SPEED (mph)	63	0	N=894	67	0	N=300
		VOLUME (vph)	1377	8	N=894	1178	11	N=300
	15	SPEED (mph)	62	0	N=890	66	0	N=308
		VOLUME (vph)	1680	10	N=890	1247	10	N=308
	16	SPEED (mph)	63	0	N=831	66	0	N=312
		VOLUME (vph)	1729	8	N=831	1212	10	N=312
	17	SPEED (mph)	62	0	N=878	65	0	N=312
		VOLUME (vph)	1601	9	N=878	1125	11	N=312

A11 Table 2. Detector B Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector B

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	63	0	N=894	64	0	N=312
		VOLUME (vph)	1191	9	N=894	966	10	N=312
	19	SPEED (mph)	63	0	N=918	65	0	N=311
		VOLUME (vph)	814	7	N=918	710	9	N=311
	20	SPEED (mph)	63	0	N=932	66	0	N=311
		VOLUME (vph)	664	6	N=932	597	7	N=311
	21	SPEED (mph)	64	0	N=939	66	0	N=311
		VOLUME (vph)	626	5	N=939	553	7	N=311
	22	SPEED (mph)	65	0	N=950	67	0	N=309
		VOLUME (vph)	488	4	N=950	423	7	N=309
	23	SPEED (mph)	66	0	N=949	67	0	N=308
		VOLUME (vph)	331	4	N=949	320	7	N=308
Table Total		SPEED (mph)	63	0	N=20731	66	0	N=6982
		VOLUME (vph)	893	4	N=20731	670	5	N=6982

A11 Table 3. Detector C Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector C

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	50	0	N=686	50	0	N=277
		VOLUME (vph)	70	1	N=686	105	3	N=277
	1	SPEED (mph)	50	0	N=373	50	0	N=203
		VOLUME (vph)	53	1	N=373	63	2	N=203
	2	SPEED (mph)	50	0	N=313	51	0	N=156
		VOLUME (vph)	49	1	N=313	57	2	N=156
	3	SPEED (mph)	51	0	N=496	50	0	N=112
		VOLUME (vph)	59	1	N=496	51	2	N=112
	4	SPEED (mph)	51	0	N=746	50	0	N=151
		VOLUME (vph)	99	2	N=746	57	2	N=151
	5	SPEED (mph)	51	0	N=813	51	0	N=223
		VOLUME (vph)	344	6	N=813	93	3	N=223
	6	SPEED (mph)	50	0	N=825	52	0	N=277
		VOLUME (vph)	763	7	N=825	163	6	N=277
	7	SPEED (mph)	49	0	N=653	52	0	N=285
		VOLUME (vph)	825	6	N=653	191	6	N=285
	8	SPEED (mph)	50	0	N=830	52	0	N=287
		VOLUME (vph)	686	5	N=830	250	7	N=287
	9	SPEED (mph)	51	0	N=847	52	0	N=288
		VOLUME (vph)	539	4	N=847	349	8	N=288
	10	SPEED (mph)	51	0	N=863	52	0	N=281
		VOLUME (vph)	513	4	N=863	479	9	N=281
	11	SPEED (mph)	51	0	N=864	52	0	N=281
		VOLUME (vph)	539	6	N=864	580	8	N=281
	12	SPEED (mph)	51	0	N=884	52	0	N=294
		VOLUME (vph)	596	5	N=884	685	9	N=294
	13	SPEED (mph)	51	0	N=836	52	0	N=300
		VOLUME (vph)	638	5	N=836	691	8	N=300
	14	SPEED (mph)	51	0	N=874	51	0	N=300
		VOLUME (vph)	804	5	N=874	739	8	N=300
	15	SPEED (mph)	51	0	N=877	52	0	N=308
		VOLUME (vph)	960	6	N=877	716	8	N=308
	16	SPEED (mph)	50	0	N=864	51	0	N=312
		VOLUME (vph)	1147	6	N=864	705	8	N=312
	17	SPEED (mph)	48	0	N=892	50	0	N=311
		VOLUME (vph)	1201	7	N=892	639	8	N=311

A11 Table 3. Detector C Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector C

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	49	0	N=862	49	0	N=308
		VOLUME (vph)	797	7	N=862	521	7	N=308
	19	SPEED (mph)	50	0	N=883	50	0	N=311
		VOLUME (vph)	485	4	N=883	379	6	N=311
	20	SPEED (mph)	50	0	N=908	50	0	N=312
		VOLUME (vph)	386	3	N=908	307	5	N=312
	21	SPEED (mph)	50	0	N=917	50	0	N=310
		VOLUME (vph)	371	3	N=917	242	4	N=310
	22	SPEED (mph)	51	0	N=924	50	0	N=312
		VOLUME (vph)	269	3	N=924	189	4	N=312
	23	SPEED (mph)	51	0	N=928	50	0	N=296
		VOLUME (vph)	141	2	N=928	131	4	N=296
Table Total		SPEED (mph)	50	0	N=18958	51	0	N=6495
		VOLUME (vph)	550	3	N=18958	380	3	N=6495

A11 Table 4. Detector D Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector D

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	45	0	N=868	46	0	N=288
		VOLUME (vph)	294	3	N=868	375	5	N=288
	1	SPEED (mph)	45	0	N=762	46	0	N=261
		VOLUME (vph)	210	2	N=762	246	4	N=261
	2	SPEED (mph)	45	0	N=748	46	0	N=256
		VOLUME (vph)	205	2	N=748	210	4	N=256
	3	SPEED (mph)	45	0	N=839	46	0	N=279
		VOLUME (vph)	259	3	N=839	186	4	N=279
	4	SPEED (mph)	46	0	N=839	46	0	N=287
		VOLUME (vph)	438	4	N=839	257	5	N=287
	5	SPEED (mph)	46	0	N=813	46	0	N=288
		VOLUME (vph)	933	8	N=813	392	9	N=288
	6	SPEED (mph)	45	0	N=809	47	0	N=288
		VOLUME (vph)	1619	10	N=809	604	12	N=288
	7	SPEED (mph)	44	0	N=698	48	0	N=288
		VOLUME (vph)	1878	8	N=698	688	12	N=288
	8	SPEED (mph)	45	0	N=806	48	0	N=288
		VOLUME (vph)	1514	6	N=806	801	13	N=288
	9	SPEED (mph)	45	0	N=823	47	0	N=288
		VOLUME (vph)	1278	5	N=823	984	13	N=288
	10	SPEED (mph)	46	0	N=837	47	0	N=281
		VOLUME (vph)	1251	5	N=837	1189	12	N=281
	11	SPEED (mph)	45	0	N=841	47	0	N=281
		VOLUME (vph)	1283	6	N=841	1340	11	N=281
	12	SPEED (mph)	45	0	N=863	47	0	N=294
		VOLUME (vph)	1387	7	N=863	1519	11	N=294
	13	SPEED (mph)	46	0	N=818	47	0	N=300
		VOLUME (vph)	1437	7	N=818	1531	10	N=300
	14	SPEED (mph)	45	0	N=868	46	0	N=300
		VOLUME (vph)	1616	6	N=868	1571	10	N=300
	15	SPEED (mph)	45	0	N=863	47	0	N=308
		VOLUME (vph)	1689	6	N=863	1506	9	N=308
	16	SPEED (mph)	45	0	N=837	46	0	N=312
		VOLUME (vph)	1808	6	N=837	1475	9	N=312
	17	SPEED (mph)	43	0	N=848	46	0	N=311
		VOLUME (vph)	1808	6	N=848	1382	10	N=311

A11 Table 4. Detector D Speed and Volume Statistics for Weekdays and Weekends-Before.

DETECTOR ID Detector D

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	44	0	N=831	45	0	N=305
		VOLUME (vph)	1445	7	N=831	1210	9	N=305
	19	SPEED (mph)	45	0	N=867	46	0	N=309
		VOLUME (vph)	1117	6	N=867	987	8	N=309
	20	SPEED (mph)	45	0	N=900	46	0	N=312
		VOLUME (vph)	967	5	N=900	832	7	N=312
	21	SPEED (mph)	46	0	N=910	46	0	N=309
		VOLUME (vph)	903	5	N=910	723	8	N=309
	22	SPEED (mph)	46	0	N=921	46	0	N=312
		VOLUME (vph)	725	5	N=921	578	8	N=312
	23	SPEED (mph)	46	0	N=929	46	0	N=312
		VOLUME (vph)	495	4	N=929	432	8	N=312
Table Total		SPEED (mph)	45	0	N=20138	46	0	N=7057
		VOLUME (vph)	1102	4	N=20138	888	6	N=7057

A11 Table 5. Detector A Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector A

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	57	0	N=888	58	0	N=282
		VOLUME (vph)	117	2	N=888	212	9	N=282
	1	SPEED (mph)	57	0	N=816	58	0	N=274
		VOLUME (vph)	86	2	N=816	110	3	N=274
	2	SPEED (mph)	57	0	N=771	58	0	N=261
		VOLUME (vph)	75	1	N=771	91	2	N=261
	3	SPEED (mph)	57	0	N=756	58	0	N=215
		VOLUME (vph)	73	1	N=756	70	2	N=215
	4	SPEED (mph)	58	0	N=863	58	0	N=206
		VOLUME (vph)	139	2	N=863	75	2	N=206
	5	SPEED (mph)	58	0	N=886	59	0	N=237
		VOLUME (vph)	538	7	N=886	135	5	N=237
	6	SPEED (mph)	57	0	N=905	59	0	N=260
		VOLUME (vph)	1308	12	N=905	251	8	N=260
	7	SPEED (mph)	54	0	N=811	59	0	N=271
		VOLUME (vph)	1580	13	N=811	375	12	N=271
	8	SPEED (mph)	57	0	N=891	58	0	N=263
		VOLUME (vph)	1216	9	N=891	511	16	N=263
	9	SPEED (mph)	58	0	N=915	58	0	N=254
		VOLUME (vph)	946	7	N=915	754	25	N=254
	10	SPEED (mph)	58	0	N=925	59	0	N=257
		VOLUME (vph)	940	6	N=925	927	23	N=257
	11	SPEED (mph)	58	0	N=926	59	0	N=263
		VOLUME (vph)	985	6	N=926	1097	20	N=263
	12	SPEED (mph)	58	0	N=932	59	0	N=264
		VOLUME (vph)	1051	7	N=932	1147	17	N=264
	13	SPEED (mph)	58	0	N=914	59	0	N=264
		VOLUME (vph)	1099	6	N=914	1109	14	N=264
	14	SPEED (mph)	58	0	N=906	60	0	N=274
		VOLUME (vph)	1333	8	N=906	1088	12	N=274
	15	SPEED (mph)	57	0	N=908	59	0	N=276
		VOLUME (vph)	1564	8	N=908	1193	12	N=276
	16	SPEED (mph)	57	0	N=884	58	0	N=276
		VOLUME (vph)	1494	9	N=884	1153	12	N=276
	17	SPEED (mph)	56	0	N=914	58	0	N=276
		VOLUME (vph)	1405	10	N=914	1053	17	N=276

A11 Table 5. Detector A Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector A

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	57	0	N=923	58	0	N=276
		VOLUME (vph)	1083	8	N=923	887	15	N=276
	19	SPEED (mph)	58	0	N=925	59	0	N=276
		VOLUME (vph)	729	7	N=925	649	11	N=276
	20	SPEED (mph)	58	0	N=909	59	0	N=276
		VOLUME (vph)	586	6	N=909	519	8	N=276
	21	SPEED (mph)	58	0	N=914	59	0	N=276
		VOLUME (vph)	560	5	N=914	499	9	N=276
	22	SPEED (mph)	59	0	N=924	59	0	N=276
		VOLUME (vph)	422	5	N=924	375	9	N=276
	23	SPEED (mph)	58	0	N=840	59	0	N=248
		VOLUME (vph)	286	5	N=840	312	11	N=248
Table Total		SPEED (mph)	57	0	N=21246	58	0	N=6301
		VOLUME (vph)	830	4	N=21246	621	6	N=6301

A11 Table 6. Detector B Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector B

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	52	0	N=845	54	0	N=287
		VOLUME (vph)	138	2	N=845	222	4	N=287
	1	SPEED (mph)	52	0	N=807	55	0	N=285
		VOLUME (vph)	100	2	N=807	132	3	N=285
	2	SPEED (mph)	52	0	N=738	56	0	N=281
		VOLUME (vph)	88	1	N=738	109	3	N=281
	3	SPEED (mph)	51	0	N=693	56	1	N=249
		VOLUME (vph)	86	1	N=693	86	2	N=249
	4	SPEED (mph)	50	0	N=793	54	1	N=239
		VOLUME (vph)	159	2	N=793	88	3	N=239
	5	SPEED (mph)	49	0	N=822	54	0	N=261
		VOLUME (vph)	571	8	N=822	152	5	N=261
	6	SPEED (mph)	48	0	N=824	55	0	N=260
		VOLUME (vph)	1344	12	N=824	277	8	N=260
	7	SPEED (mph)	47	0	N=848	55	0	N=269
		VOLUME (vph)	1632	12	N=848	423	12	N=269
	8	SPEED (mph)	48	0	N=851	54	0	N=250
		VOLUME (vph)	1279	9	N=851	559	14	N=250
	9	SPEED (mph)	48	0	N=882	53	0	N=257
		VOLUME (vph)	1007	7	N=882	725	16	N=257
	10	SPEED (mph)	47	0	N=902	52	0	N=261
		VOLUME (vph)	986	6	N=902	910	15	N=261
	11	SPEED (mph)	47	0	N=903	53	0	N=256
		VOLUME (vph)	1034	6	N=903	1083	14	N=256
	12	SPEED (mph)	48	0	N=916	52	0	N=264
		VOLUME (vph)	1093	6	N=916	1180	13	N=264
	13	SPEED (mph)	48	0	N=901	52	0	N=264
		VOLUME (vph)	1163	6	N=901	1175	11	N=264
	14	SPEED (mph)	48	0	N=892	53	0	N=274
		VOLUME (vph)	1397	8	N=892	1177	10	N=274
	15	SPEED (mph)	48	0	N=863	52	0	N=276
		VOLUME (vph)	1642	8	N=863	1278	11	N=276
	16	SPEED (mph)	49	0	N=820	52	0	N=276
		VOLUME (vph)	1575	10	N=820	1220	11	N=276
	17	SPEED (mph)	48	0	N=866	51	0	N=276
		VOLUME (vph)	1497	10	N=866	1088	12	N=276

A11 Table 6. Detector B Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector B

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	48	0	N=883	51	0	N=276
		VOLUME (vph)	1173	10	N=883	925	11	N=276
	19	SPEED (mph)	50	0	N=886	51	0	N=276
		VOLUME (vph)	819	10	N=886	708	10	N=276
	20	SPEED (mph)	50	0	N=870	52	0	N=276
		VOLUME (vph)	657	10	N=870	581	7	N=276
	21	SPEED (mph)	50	0	N=868	52	0	N=276
		VOLUME (vph)	642	10	N=868	558	9	N=276
	22	SPEED (mph)	52	0	N=884	54	0	N=276
		VOLUME (vph)	490	10	N=884	410	8	N=276
	23	SPEED (mph)	53	0	N=789	54	0	N=248
		VOLUME (vph)	333	7	N=789	313	7	N=248
Table Total		SPEED (mph)	49	0	N=20346	53	0	N=6413
		VOLUME (vph)	889	4	N=20346	644	6	N=6413

A11 Table 7. Detector C Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector C

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	48	0	N=688	48	0	N=280
		VOLUME (vph)	99	5	N=688	105	3	N=280
	1	SPEED (mph)	47	0	N=505	48	0	N=231
		VOLUME (vph)	91	7	N=505	66	2	N=231
	2	SPEED (mph)	48	0	N=477	48	0	N=213
		VOLUME (vph)	88	7	N=477	60	2	N=213
	3	SPEED (mph)	48	0	N=573	47	0	N=120
		VOLUME (vph)	91	6	N=573	49	1	N=120
	4	SPEED (mph)	49	0	N=771	48	0	N=153
		VOLUME (vph)	152	5	N=771	62	2	N=153
	5	SPEED (mph)	49	0	N=824	48	0	N=214
		VOLUME (vph)	352	6	N=824	88	3	N=214
	6	SPEED (mph)	48	0	N=765	49	0	N=258
		VOLUME (vph)	735	7	N=765	158	5	N=258
	7	SPEED (mph)	48	0	N=569	50	0	N=263
		VOLUME (vph)	775	9	N=569	203	6	N=263
	8	SPEED (mph)	49	0	N=764	50	0	N=247
		VOLUME (vph)	679	6	N=764	259	7	N=247
	9	SPEED (mph)	49	0	N=876	51	0	N=242
		VOLUME (vph)	581	5	N=876	356	9	N=242
	10	SPEED (mph)	50	0	N=881	50	0	N=253
		VOLUME (vph)	563	4	N=881	466	9	N=253
	11	SPEED (mph)	50	0	N=892	50	0	N=262
		VOLUME (vph)	607	4	N=892	611	9	N=262
	12	SPEED (mph)	50	0	N=905	50	0	N=252
		VOLUME (vph)	656	4	N=905	703	8	N=252
	13	SPEED (mph)	49	0	N=894	50	0	N=249
		VOLUME (vph)	724	5	N=894	711	8	N=249
	14	SPEED (mph)	49	0	N=883	50	0	N=258
		VOLUME (vph)	885	6	N=883	748	9	N=258
	15	SPEED (mph)	49	0	N=890	50	0	N=264
		VOLUME (vph)	1036	7	N=890	757	8	N=264
	16	SPEED (mph)	48	0	N=850	49	0	N=267
		VOLUME (vph)	1231	8	N=850	734	8	N=267
	17	SPEED (mph)	47	0	N=814	48	0	N=273
		VOLUME (vph)	1287	8	N=814	641	8	N=273

A11 Table 7. Detector C Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector C

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	47	0	N=850	47	0	N=272
		VOLUME (vph)	854	8	N=850	508	8	N=272
	19	SPEED (mph)	48	0	N=859	47	0	N=276
		VOLUME (vph)	547	5	N=859	385	7	N=276
	20	SPEED (mph)	48	0	N=833	48	0	N=276
		VOLUME (vph)	429	4	N=833	313	5	N=276
	21	SPEED (mph)	48	0	N=849	48	0	N=276
		VOLUME (vph)	389	4	N=849	257	5	N=276
	22	SPEED (mph)	49	0	N=854	48	0	N=275
		VOLUME (vph)	278	4	N=854	206	5	N=275
	23	SPEED (mph)	49	0	N=779	48	0	N=245
		VOLUME (vph)	181	4	N=779	137	4	N=245
Table Total		SPEED (mph)	48	0	N=18845	49	0	N=5919
		VOLUME (vph)	583	3	N=18845	376	4	N=5919

A11 Table 8. Detector D Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector D

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	0	SPEED (mph)	48	0	N=852	48	0	N=288
		VOLUME (vph)	324	10	N=852	365	5	N=288
	1	SPEED (mph)	47	0	N=850	48	0	N=286
		VOLUME (vph)	246	10	N=850	245	4	N=286
	2	SPEED (mph)	47	0	N=872	48	0	N=287
		VOLUME (vph)	241	10	N=872	222	3	N=287
	3	SPEED (mph)	48	0	N=861	48	0	N=276
		VOLUME (vph)	290	10	N=861	180	3	N=276
	4	SPEED (mph)	48	0	N=863	48	0	N=267
		VOLUME (vph)	512	10	N=863	269	6	N=267
	5	SPEED (mph)	49	0	N=875	49	0	N=264
		VOLUME (vph)	925	10	N=875	400	8	N=264
	6	SPEED (mph)	48	0	N=849	49	0	N=264
		VOLUME (vph)	1537	13	N=849	592	11	N=264
	7	SPEED (mph)	45	0	N=813	50	0	N=264
		VOLUME (vph)	1741	12	N=813	711	11	N=264
	8	SPEED (mph)	47	0	N=824	50	0	N=252
		VOLUME (vph)	1434	10	N=824	786	13	N=252
	9	SPEED (mph)	49	0	N=868	50	0	N=251
		VOLUME (vph)	1246	6	N=868	948	13	N=251
	10	SPEED (mph)	49	0	N=870	50	0	N=261
		VOLUME (vph)	1248	5	N=870	1135	11	N=261
	11	SPEED (mph)	49	0	N=880	50	0	N=263
		VOLUME (vph)	1328	6	N=880	1319	11	N=263
	12	SPEED (mph)	49	0	N=901	50	0	N=252
		VOLUME (vph)	1397	6	N=901	1485	10	N=252
	13	SPEED (mph)	48	0	N=893	50	0	N=251
		VOLUME (vph)	1465	6	N=893	1497	11	N=251
	14	SPEED (mph)	48	0	N=884	50	0	N=261
		VOLUME (vph)	1594	7	N=884	1544	11	N=261
	15	SPEED (mph)	48	0	N=890	50	0	N=263
		VOLUME (vph)	1642	7	N=890	1519	10	N=263
	16	SPEED (mph)	47	0	N=853	50	0	N=267
		VOLUME (vph)	1728	7	N=853	1455	11	N=267
	17	SPEED (mph)	46	0	N=808	49	0	N=272
		VOLUME (vph)	1729	8	N=808	1338	10	N=272

A11 Table 8. Detector D Speed and Volume Statistics for Weekdays and Weekends-After.

DETECTOR ID Detector D

			WEEK-DAY/END					
			Weekday			Weekend		
			Mean	Standard Error of Mean	Valid N	Mean	Standard Error of Mean	Valid N
HOUR	18	SPEED (mph)	46	0	N=846	48	0	N=273
		VOLUME (vph)	1405	8	N=846	1151	10	N=273
	19	SPEED (mph)	47	0	N=860	48	0	N=276
		VOLUME (vph)	1107	8	N=860	943	9	N=276
	20	SPEED (mph)	48	0	N=835	48	0	N=276
		VOLUME (vph)	981	8	N=835	810	8	N=276
	21	SPEED (mph)	48	0	N=849	48	0	N=276
		VOLUME (vph)	887	8	N=849	695	7	N=276
	22	SPEED (mph)	48	0	N=855	49	0	N=276
		VOLUME (vph)	699	9	N=855	581	8	N=276
	23	SPEED (mph)	49	0	N=785	48	0	N=249
		VOLUME (vph)	539	10	N=785	440	8	N=249
Table Total		SPEED (mph)	48	0	N=20536	49	0	N=6415
		VOLUME (vph)	1095	4	N=20536	850	6	N=6415

APPENDIX 12
Crash Summary Tables Before and After Periods

A12 Table 1. Test Ramp Crash Listing Before and After Periods.

Analysis Period	Total Number of Injuries	Road Conditions	Total Number of Vehicles	Driver Intent	Crash Hour	Day of Week	Crash Severity	Light Condition	Manner of Collision	Vehicle 1 Type	Vehicle 2 Type	ACCDDATE
BEFORE	0	Wet	2	Negotiate Curve	0	Wednesday	Property	Dark-Lighted	Side-Swipe Same	Car	Semi Truck	25-JUN-1997
	1	Dry	2	Go Straight	6	Monday	Injury	Daylight	Angle	Car	Utility Truck	27-OCT-1997
	0	Wet	1	Negotiate Curve	21	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		29-NOV-1997
	0	Wet	1	Negotiate Curve	21	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		29-NOV-1997
	1	Wet	1	Negotiate Curve	14	Tuesday	Injury	Daylight	No Coll w/MV	Car		27-OCT-1998
	0	Dry	2	Overtake-Left	20	Thursday	Property	Dark-Lighted	Side-Swipe Same	Car	Semi Truck	17-DEC-1998
	1	Dry	1	Negotiate Curve	20	Wednesday	Injury	Daylight	No Coll w/MV	Semi Truck	.	24-JUN-1998
	1	Wet	1	Negotiate Curve	0	Monday	Injury	Dark-Lighted	No Coll w/MV	Semi Truck	.	05-JAN-1998
	0	Dry	3	Slowing/Stopping	8	Thursday	Property	Dawn	Rear-End	Car	Car	31-DEC-1998
	0	Wet	1	Negotiate Curve	1	Sunday	Property	Dark-Lighted	No Coll w/MV	Car	.	01-FEB-1998
	0	Dry	2	Go Straight	21	Saturday	Property	Dark-Lighted	Rear-End	Car	Car	26-SEP-1998
	1	Dry	3	Change Lanes	5	Sunday	Injury	Dawn	Rear-End	Car	Utility Truck	13-SEP-1998
	0	Dry	2	Change Lanes	10	Monday	Property	Daylight	Side-Swipe Same	Car	Car	05-APR-1999
	0	Ice	5	Slowing/Stopping	10	Wednesday	Property	Daylight	Side-Swipe Same	Semi Truck	Semi Truck	13-JAN-1999
N	14	14	14	14	14	14	14	14	14	14	14	14
AFTER	0	Ice	2	Negotiate Curve	19	Thursday	Property	Dark-Lighted	Rear-End	Car	Car	23-DEC-1999
	0	Snow	3	Slowing/Stopping	19	Thursday	Property	Dark-Lighted	Rear-End	Car	Car	23-DEC-1999
	0	Ice	1	Negotiate Curve	21	Thursday	Property	Dark-Lighted	No Coll w/MV	Car		23-DEC-1999
	0	Wet	1	Negotiate Curve	20	Saturday	Property	Dark-Lighted	No Coll w/MV	Semi Truck		04-DEC-1999
	0	Dry	1	Blank	0	Saturday	Property	Daylight	No Coll w/MV	Car	.	20-MAY-2000
	0	Wet	2	Negotiate Curve	10	Saturday	Property	Daylight	Side-Swipe Same	Car	Car	01-JAN-2000
	0	Dry	1	Negotiate Curve	0	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		15-JAN-2000
	1	Wet	1	Negotiate Curve	30	Tuesday	Injury	Dark-Lighted	No Coll w/MV	Car		30-JAN-2001
N	8	8	8	8	8	8	8	8	8	8	8	8

A12 Table 2. Test Ramp Crashes: Single- or Multi-Vehicle/Crash Severity/Hour of Occurrence-Before.

Analysis Period BEFORE

		Single- or Multi-Vehicle				
		Single		Multiple		
		Crash Severity		Crash Severity		
		Injury	Property	Injury	Property	Table Total
Crash Hour[a,b]	0	1			1	2
	1		1			1
	5			1		1
	6			1		1
	8				1	1
	10				2	2
	14	1				1
	19					
	20	1			1	2
	21		2		1	3
	30					
Table Total		3	3	2	6	14

a. Hour = 1 includes crashes occurring at or after 1:00 am and before 2:00 am.

b. Hour = 30 Hour of occurrence unknown.

A12 Table 3. Test Ramp Crashes: Single- or Multi-Vehicle/Light Condition.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Light Condition	Daylight	2	3	1	1	7
	Dawn		2			2
	Dark-Lighted	4	3	4	2	13
Table Total		6	8	5	3	22

A12 Table 4. Test Ramp Crashes: Single- or Multi-Vehicle/Pavement Condition.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Pavement Condition	Dry	1	6	2		9
	Ice		1	1	1	3
	Snow				1	1
	Wet	5	1	2	1	9
Table Total		6	8	5	3	22

A12 Table 5. Test Ramp Crashes: Number of Involved Vehicles.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Total Number of Vehicles	1	6		5		11
	2		5		2	7
	3		2		1	3
	5		1			1
Table Total		6	8	5	3	22

A12 Table 6. Test Ramp Crashes: Single- or Multi-Vehicle/Crash Severity.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Crash Severity	Injury	3	2	1		6
	Property	3	6	4	3	16
Table Total		6	8	5	3	22

A12 Table 7. Test Ramp Crashes: Single- or Multi-Vehicle/Day of Week.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Day of Week	Sunday	1	1			2
	Monday	1	2			3
	Tuesday	1		1		2
	Wednesday	1	2			3
	Thursday		2	1	2	5
	Saturday	2	1	3	1	7
Table Total		6	8	5	3	22

A12 Table 8. Test Ramp Crashes: Single- or Multi-Vehicle/Crash Type.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Crash Type	Collision w/MV[a]		5		3	8
	Impact Attenuator	1				1
	Bridge Pier		1			1
	Deer			1		1
	Median Barrier	3	1	2		6
	Non-Fixed Object	1				1
	Overturn			1		1
	Non-Collision		1			1
	Other Fixed Object	1		1		2
Table Total		6	8	5	3	22

a. MV = Motor Vehicle

A12 Table 9. Test Ramp Crashes: Single- or Multi-Vehicle/Crash Severity/Hour of Occurrence-After.

Analysis Period AFTER

		Single- or Multi-Vehicle				
		Single		Multiple		
		Crash Severity		Crash Severity		
		Injury	Property	Injury	Property	Table Total
Crash Hour[a,b]	0		2			2
	1					
	5					
	6					
	8					
	10				1	1
	14					
	19				2	2
	20		1			1
	21		1			1
	30	1				1
Table Total		1	4		3	8

a. Hour = 1 includes crashes occurring at or after 1:00 am and before 2:00 am.

b. Hour = 30 Hour of occurrence unknown.

A12 Table 10. Control Ramp Crash Listing Before and After Periods.

Analysis Period	Total Number of Injuries	Road Conditions	Total Number of Vehicles	Driver Intent	Crash Hour	Day of Week	Crash Severity	Light Condition	Manner of Collision	Vehicle 1 Type	Vehicle 2 Type	ACCDDATE
BEFORE	0	Wet	2	Negotiate Curve	16	Monday	Property	Daylight	Angle	Car	Car	18-JAN-1999
	0	Wet	1	Negotiate Curve	6	Friday	Property	Daylight	No Coll w/MV	Utility Truck	.	16-APR-1999
	0	Wet	1	Negotiate Curve	16	Monday	Property	Daylight	No Coll w/MV	Straight Truck		18-JAN-1999
	1	Wet	1	Negotiate Curve	3	Saturday	Injury	Dark-Lighted	No Coll w/MV	Car		23-JAN-1999
	0	Wet	1	Negotiate Curve	10	Tuesday	Property	Daylight	No Coll w/MV	Car	.	02-FEB-1999
	1	Dry	4	Go Straight	11	Tuesday	Injury	Daylight	No Coll w/MV	Car	Car	13-APR-1999
	1	Wet	2	Negotiate Curve	21	Sunday	Injury	Dark-Lighted	Rear-End	Car	Car	20-DEC-1998
	0	Wet	1	Negotiate Curve	9	Monday	Property	Daylight	No Coll w/MV	Car		30-NOV-1998
	0	Dry	1	Negotiate Curve	21	Sunday	Property	Dark-Lighted	No Coll w/MV	Car		11-JAN-1998
	0	Dry	1	Negotiate Curve	11	Tuesday	Property	Daylight	No Coll w/MV	Car		03-FEB-1998
	0	Dry	1	Negotiate Curve	23	Monday	Property	Dark-Lighted	No Coll w/MV	Car		16-FEB-1998
	0	Wet	1	Negotiate Curve	16	Sunday	Property	Daylight	No Coll w/MV	Car		03-MAY-1998
	0	Wet	1	Negotiate Curve	13	Sunday	Property	Daylight	No Coll w/MV	Utility Truck		03-MAY-1998
	0	Wet	1	Go Straight	11	Tuesday	Property	Daylight	No Coll w/MV	Car		07-JUL-1998
	0	Wet	2	Negotiate Curve	8	Sunday	Property	Daylight	Head-On	Car	Car	23-AUG-1998
	0	Wet	1	Negotiate Curve	12	Monday	Property	Daylight	Blank	Utility Truck		14-SEP-1998
	0	Dry	1	Go Straight	11	Thursday	Property	Daylight	No Coll w/MV	Blank		17-SEP-1998
	1	Wet	2	Go Straight	5	Monday	Injury	Dark-Lighted	Angle	Car	Car	14-SEP-1998
	1	Wet	1	Negotiate Curve	0	Saturday	Injury	Dark-Lighted	No Coll w/MV	Car		03-OCT-1998
	0	Wet	3	Slowing/Stopping	15	Monday	Property	Daylight	No Coll w/MV	Semi Truck	Utility Truck	05-OCT-1998
	0	Wet	1	Negotiate Curve	2	Sunday	Property	Dark-Lighted	No Coll w/MV	Car		18-OCT-1998
	0	Wet	1	Negotiate Curve	14	Tuesday	Property	Daylight	No Coll w/MV	Car		27-OCT-1998
	0	Wet	1	Negotiate Curve	8	Sunday	Property	Daylight	No Coll w/MV	Car		08-NOV-1998
	1	Wet	1	Negotiate Curve	22	Monday	Injury	Dark-Lighted	No Coll w/MV	Car		02-MAR-1998
	0	Wet	1	Negotiate Curve	8	Wednesday	Property	Daylight	No Coll w/MV	Utility Truck		08-APR-1998
	1	Wet	2	Go Straight	10	Thursday	Injury	Daylight	Angle	Utility Truck	Car	07-MAY-1998
	0	Wet	1	Negotiate Curve	8	Saturday	Property	Daylight	No Coll w/MV	Car		03-OCT-1998
	0	Dry	2	Change Lanes	9	Tuesday	Property	Daylight	Side-Swipe Same	Car	Semi Truck	03-NOV-1998
	0	Wet	1	Go Straight	14	Sunday	Property	Daylight	No Coll w/MV	Car		06-DEC-1998
	1	Dry	1	Negotiate Curve	5	Monday	Injury	Dark-Lighted	No Coll w/MV	Car		14-DEC-1998
	0	Dry	2	Change Lanes	23	Friday	Property	Dark-Lighted	Side-Swipe Same	Semi Truck	Utility Truck	26-JUN-1998
	0	Dry	1	Negotiate Curve	16	Saturday	Property	Daylight	No Coll w/MV	Car	.	18-APR-1998
	0	Wet	1	Negotiate Curve	10	Monday	Property	Daylight	No Coll w/MV	Car	.	30-NOV-1998
	0	Wet	2	Go Straight	15	Sunday	Property	Daylight	Rear-End	Car	Car	06-DEC-1998
	0	Dry	2	Negotiate Curve	14	Thursday	Property	Daylight	Side-Swipe Same	Car	Car	26-NOV-1998
	1	Wet	1	Negotiate Curve	21	Monday	Injury	Dark-Lighted	No Coll w/MV	Car	.	09-NOV-1998
	0	Wet	2	Negotiate Curve	18	Monday	Property	Dark-Lighted	No Coll w/MV	Car	Blank	05-OCT-1998
	1	Dry	1	Negotiate Curve	14	Tuesday	Injury	Daylight	No Coll w/MV	Utility Truck	.	06-OCT-1998
	0	Wet	1	Negotiate Curve	22	Thursday	Property	Dark-Lighted	No Coll w/MV	Car	.	29-OCT-1998
	1	Wet	1	Negotiate Curve	15	Saturday	Injury	Daylight	No Coll w/MV	Car	.	17-OCT-1998
	0	Wet	1	Negotiate Curve	6	Saturday	Property	Dawn	No Coll w/MV	Car	.	03-OCT-1998
	0	Wet	1	Negotiate Curve	6	Saturday	Property	Dawn	No Coll w/MV	Car	.	17-OCT-1998
	0	Wet	1	Negotiate Curve	8	Saturday	Property	Daylight	No Coll w/MV	Car	.	17-OCT-1998
	0	Wet	1	Negotiate Curve	1	Tuesday	Property	Dark-Lighted	No Coll w/MV	Utility Truck	.	21-APR-1998

A12 Table 10. Control Ramp Crash Listing Before and After Periods (Continued)

Analysis Period	Total Number of Injuries	Road Conditions	Total Number of Vehicles	Driver Intent	Crash Hour	Day of Week	Crash Severity	Light Condition	Manner of Collision	Vehicle 1 Type	Vehicle 2 Type	ACCDDATE
BEFORE	0	Wet	1	Negotiate Curve	0	Saturday	Property	Dark-Lighted	No Coll w/MV	Car	.	26-SEP-1998
	0	Wet	1	Negotiate Curve	22	Wednesday	Property	Dark-Lighted	No Coll w/MV	Car	.	08-APR-1998
	0	Wet	1	Negotiate Curve	20	Wednesday	Property	Dark-Lighted	No Coll w/MV	Car	.	08-APR-1998
	0	Wet	1	Negotiate Curve	0	Sunday	Property	Dark-Lighted	No Coll w/MV	Car	.	26-APR-1998
	0	Wet	2	Negotiate Curve	17	Tuesday	Property	Daylight	Angle	Car	Car	31-MAR-1998
	1	Wet	1	Negotiate Curve	23	Monday	Injury	Dark-Lighted	No Coll w/MV	Car	.	20-JUL-1998
	0	Wet	1	Negotiate Curve	8	Saturday	Property	Daylight	No Coll w/MV	Utility Truck	.	02-MAY-1998
	0	Wet	2	Negotiate Curve	14	Tuesday	Property	Daylight	Side-Swipe Same	Car	Semi Truck	06-OCT-1998
	0	Blank	2	Negotiate Curve	14	Friday	Property	Daylight	Side-Swipe Same	Blank	Car	30-OCT-1998
	0	Wet	1	Negotiate Curve	12	Monday	Property	Daylight	No Coll w/MV	Car	.	09-NOV-1998
	1	Wet	2	Negotiate Curve	21	Friday	Injury	Dark-Lighted	Angle	Straight Truck	Car	03-JUL-1998
	1	Wet	2	Change Lanes	19	Friday	Injury	Daylight	No Coll w/MV	Car	Car	03-JUL-1998
	0	Dry	2	Other	13	Friday	Property	Daylight	Side-Swipe Same	Utility Truck	OTR	16-MAY-1997
	0	Dry	2	Negotiate Curve	20	Friday	Property	Dark-Lighted	Side-Swipe Same	Car	Semi Truck	30-MAY-1997
	0	Dry	1	Go Straight	11	Friday	Property	Daylight	No Coll w/MV	Car		20-JUN-1997
	1	Wet	1	Negotiate Curve	2	Saturday	Injury	Dark-Lighted	No Coll w/MV	Car		21-JUN-1997
	1	Wet	2	Slowing/Stopping	2	Monday	Injury	Dark-Lighted	Side-Swipe Oppos	Car	Car	21-JUL-1997
	0	Wet	2	Slowing/Stopping	6	Friday	Property	Daylight	No Coll w/MV	Semi Truck	Car	19-SEP-1997
	0	Wet	1	Negotiate Curve	19	Sunday	Property	Dark-Lighted	No Coll w/MV	Car		26-OCT-1997
	1	Wet	1	Negotiate Curve	13	Sunday	Injury	Daylight	No Coll w/MV	Car		09-NOV-1997
	0	Wet	1	Go Straight	21	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		15-NOV-1997
	0	Wet	1	Negotiate Curve	14	Thursday	Property	Daylight	No Coll w/MV	Car		27-NOV-1997
	0	Wet	2	Slowing/Stopping	11	Thursday	Property	Daylight	Rear-End	Straight Truck	Car	27-NOV-1997
	0	Dry	1	Negotiate Curve	20	Friday	Property	Dark-Lighted	No Coll w/MV	Car		28-NOV-1997
	0	Wet	1	Negotiate Curve	9	Friday	Property	Daylight	No Coll w/MV	Car		28-NOV-1997
	0	Dry	2	Other	7	Friday	Property	Daylight	Angle	Utility Truck	Car	28-NOV-1997
	0	Wet	1	Negotiate Curve	18	Saturday	Property	Dark-Lighted	No Coll w/MV	Car	Car	29-NOV-1997
	1	Wet	1	Negotiate Curve	14	Wednesday	Injury	Daylight	No Coll w/MV	Car		03-DEC-1997
	1	Wet	1	Negotiate Curve	14	Wednesday	Injury	Daylight	No Coll w/MV	Car		03-DEC-1997
N	73	73	73	73	73	73	73	73	73	73	73	73
AFTER	0	Dry	2	Negotiate Curve	16	Wednesday	Property	Dusk	Side-Swipe Same	Car	Car	03-JAN-2001
	0	Dry	2	Negotiate Curve	20	Thursday	Property	Dark-Lighted	Angle	Car	Semi Truck	25-JAN-2001
	1	Dry	2	Negotiate Curve	17	Thursday	Injury	Dusk	Side-Swipe Same	Car	Car	22-FEB-2001
	0	Dry	2	Negotiate Curve	13	Tuesday	Property	Dark-Lighted	No Coll w/MV	Car	Car	20-FEB-2001
	0	Wet	1	Negotiate Curve	7	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		21-APR-2001
	0	Wet	1	Negotiate Curve	16	Wednesday	Property	Daylight	No Coll w/MV	Car		31-MAY-2000
	0	Wet	1	Slowing/Stopping	13	Sunday	Property	Daylight	No Coll w/MV	Car		28-MAY-2000
	0	Wet	3	Slowing/Stopping	12	Wednesday	Property	Daylight	No Coll w/MV	Utility Truck	Car	31-MAY-2000
	1	Wet	1	Slowing/Stopping	11	Sunday	Injury	Daylight	No Coll w/MV	Car		28-MAY-2000
	0	Wet	1	Change Lanes	11	Thursday	Property	Daylight	No Coll w/MV	Car	.	17-AUG-2000
	1	Wet	1	Negotiate Curve	7	Saturday	Injury	Daylight	No Coll w/MV	Car	.	23-SEP-2000
	2	Dry	2	Slowing/Stopping	7	Saturday	Injury	Daylight	Rear-End	Semi Truck	Car	23-SEP-2000
	1	Wet	1	Negotiate Curve	13	Monday	Injury	Daylight	No Coll w/MV	Car	.	11-SEP-2000

A12 Table 10. Control Ramp Crash Listing Before and After Periods (Continued).

Analysis Period	Total Number of Injuries	Road Conditions	Total Number of Vehicles	Driver Intent	Crash Hour	Day of Week	Crash Severity	Light Condition	Manner of Collision	Vehicle 1 Type	Vehicle 2 Type	ACCDDATE
AFTER	0	Dry	1	Negotiate Curve	1	Friday	Fatal	Dark-Lighted	No Coll w/MV	Semi Truck		25-FEB-2000
	0	Dry	2	Change Lanes	9	Wednesday	Property	Daylight	Side-Swipe Same	Car	Straight Truck	22-MAR-2000
	0	Dry	1	Negotiate Curve	6	Monday	Property	Dawn	No Coll w/MV	Blank		17-JAN-2000
	0	Dry	2	Other	0	Tuesday	Property	Dark-Lighted	Side-Swipe Oppos	Car	Car	11-JAN-2000
	0	Wet	1	Negotiate Curve	3	Friday	Property	Dark-Lighted	No Coll w/MV	Car		12-MAY-2000
	0	Wet	2	Negotiate Curve	9	Sunday	Property	Daylight	Side-Swipe Same	Car	Car	28-MAY-2000
	0	Wet	2	Negotiate Curve	17	Saturday	Property	Daylight	Rear-End	Utility Truck	Car	27-MAY-2000
	0	Dry	1	Negotiate Curve	19	Saturday	Property	Dusk	No Coll w/MV	Car		27-MAY-2000
	0	Wet	1	Negotiate Curve	20	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		27-MAY-2000
	0	Wet	1	Negotiate Curve	11	Saturday	Property	Daylight	No Coll w/MV	Car		27-MAY-2000
	1	Wet	1	Negotiate Curve	12	Saturday	Injury	Daylight	No Coll w/MV	Car		27-MAY-2000
	0	Wet	1	Negotiate Curve	21	Thursday	Property	Dark-Lighted	No Coll w/MV	Car		18-MAY-2000
	0	Dry	2	Change Lanes	8	Monday	Property	Daylight	Side-Swipe Same	Semi Truck	Utility Truck	13-MAR-2000
	0	Wet	2	Go Straight	0	Tuesday	Property	Dark-Lighted	No Coll w/MV	Utility Truck	Blank	09-MAY-2000
	0	Wet	2	Negotiate Curve	5	Friday	Property	Dawn	Angle	Car	Utility Truck	19-MAY-2000
	1	Dry	1	Negotiate Curve	18	Sunday	Injury	Dark-Lighted	No Coll w/MV	Car	.	12-NOV-2000
	0	Dry	2	Change Lanes	4	Wednesday	Property	Dawn	Angle	Utility Truck	Car	20-DEC-2000
	2	Wet	1	Negotiate Curve	12	Monday	Injury	Daylight	No Coll w/MV	Car	.	23-OCT-2000
	0	Wet	1	Negotiate Curve	22	Thursday	Property	Dark-Lighted	No Coll w/MV	Utility Truck	.	05-OCT-2000
	0	Wet	2	Negotiate Curve	22	Thursday	Property	Dark-Lighted	Angle	Car	Car	05-OCT-2000
	0	Wet	1	Negotiate Curve	2	Tuesday	Property	Dark-Lighted	No Coll w/MV	Car	.	07-NOV-2000
	1	Wet	2	Negotiate Curve	20	Sunday	Injury	Dark-Lighted	Blank	Utility Truck	Car	26-NOV-2000
	0	Wet	1	Negotiate Curve	3	Tuesday	Property	Dark-Lighted	No Coll w/MV	Utility Truck	.	07-NOV-2000
	0	Wet	1	Negotiate Curve	14	Monday	Property	Daylight	No Coll w/MV	Semi Truck	.	23-OCT-2000
	0	Wet	2	Negotiate Curve	20	Sunday	Property	Dark-Lighted	Rear-End	Car	Car	26-NOV-2000
	0	Wet	1	Negotiate Curve	20	Sunday	Property	Dark-Lighted	No Coll w/MV	Car	.	26-NOV-2000
	1	Dry	2	Slowing/Stopping	17	Saturday	Injury	Dark-Lighted	Rear-End	Car	MC	11-NOV-2000
	1	Dry	2	Change Lanes	8	Monday	Injury	Daylight	Side-Swipe Same	Car	Car	15-NOV-1999
	0	Wet	2	Negotiate Curve	12	Monday	Property	Daylight	Side-Swipe Same	Car	Semi Truck	27-SEP-1999
	1	Wet	2	Slowing/Stopping	17	Monday	Injury	Daylight	Rear-End	Car	Car	27-SEP-1999
	0	Dry	2	Change Lanes	12	Friday	Property	Daylight	Angle	Blank	Car	17-DEC-1999
	1	Wet	1	Negotiate Curve	5	Wednesday	Injury	Dark-Lighted	No Coll w/MV	Car		15-DEC-1999
	0	Wet	1	Negotiate Curve	11	Wednesday	Property	Daylight	No Coll w/MV	Car		15-DEC-1999
	0	Dry	1	Negotiate Curve	11	Wednesday	Property	Daylight	No Coll w/MV	Semi Truck		15-DEC-1999
	0	Wet	1	Slowing/Stopping	8	Tuesday	Property	Daylight	No Coll w/MV	Utility Truck		28-SEP-1999
	1	Wet	1	Negotiate Curve	22	Wednesday	Injury	Dark-Lighted	No Coll w/MV	Utility Truck		18-AUG-1999
	1	Wet	1	Negotiate Curve	11	Saturday	Injury	Daylight	No Coll w/MV	Car		17-JUL-1999
	1	Wet	2	Change Lanes	14	Sunday	Injury	Daylight	No Coll w/MV	Car	Car	05-DEC-1999
	0	Wet	1	Slowing/Stopping	6	Saturday	Property	Dark-Lighted	No Coll w/MV	Car		02-OCT-1999
	1	Wet	1	Negotiate Curve	22	Tuesday	Injury	Dark-Lighted	No Coll w/MV	Car		28-SEP-1999
	2	Wet	1	Negotiate Curve	7	Tuesday	Injury	Daylight	No Coll w/MV	Car		23-NOV-1999
	0	Wet	1	Negotiate Curve	9	Wednesday	Property	Daylight	No Coll w/MV	Car		13-OCT-1999
	0	Wet	2	Negotiate Curve	11	Saturday	Property	Daylight	No Coll w/MV	Car	Car	07-AUG-1999
	0	Wet	1	Negotiate Curve	14	Friday	Property	Daylight	No Coll w/MV	Car	.	03-DEC-1999

A12 Table 10. Control Ramp Crash Listing Before and After Periods (Continued).

Analysis Period	Total Number of Injuries	Road Conditions	Total Number of Vehicles	Driver Intent	Crash Hour	Day of Week	Crash Severity	Light Condition	Manner of Collision	Vehicle 1 Type	Vehicle 2 Type	ACCDDATE
AFTER	0	Wet	1	Negotiate Curve	5	Thursday	Property	Dark-Lighted	No Coll w/MV	Car		19-AUG-1999
	0	Wet	1	Negotiate Curve	9	Wednesday	Property	Daylight	No Coll w/MV	Car		13-OCT-1999
N	59	59	59	59	59	59	59	59	59	59	59	59

A12 Table 11. Control Ramp Crashes Period: Single- or Multi-Vehicle/Crash Severity/Hour of Occurrence-Before.

Analysis Period BEFORE

		Single- or Multi-Vehicle					
		Single			Multiple		
		Crash Severity			Crash Severity		
		Fatal	Injury	Property	Injury	Property	Table Total
Crash Hour[a]	0		1	2			3
	1			1			1
	2		1	1	1		3
	3		1				1
	4						
	5		1		1		2
	6			3		1	4
	7					1	1
	8			5		1	6
	9			2		1	3
	10			2	1		3
	11			4	1	1	6
	12			2			2
	13		1	1		1	3
	14		3	3		3	9
	15		1			2	3
	16			3		1	4
	17					1	1
	18			1		1	2
	19			1	1		2
	20			2		1	3
	21		1	2	2		5
	22		1	2			3
	23		1	1		1	3
Table Total			12	38	7	16	73

a. Hour = 1 includes crashes occurring at or after 1:00 am and before 2:00 am.

A12 Table 12. Control Ramp Crashes: Single- or Multi-Vehicle/Light Condition.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Light Condition	Daylight	28	16	18	12	74
	Dawn	2		1	2	5
	Dusk			1	2	3
	Dark-Lighted	20	7	15	8	50
Table Total		50	23	35	24	132

A12 Table 13. Control Ramp Crashes: Single- or Multi-Vehicle/Pavement Condition.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Pavement Condition	Blank		1			1
	Dry	9	7	5	12	33
	Wet	41	15	30	12	98
Table Total		50	23	35	24	132

A12 Table 14. Control Ramp Crashes: Number of Involved Vehicles.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Total Number of Vehicles	1	50		35		85
	2		21		23	44
	3		1		1	2
	4		1			1
Table Total		50	23	35	24	132

A12 Table 15. Control Ramp Crashes: Single- or Multi-Vehicle/Crash Severity.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Crash Severity	Fatal			1		1
	Injury	12	7	11	7	37
	Property	38	16	23	17	94
Table Total		50	23	35	24	132

A12 Table 16. Control Ramp Crashes: Single- or Multi-Vehicle/Day of Week.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Day of Week	Sunday	9	3	4	4	20
	Monday	10	5	4	4	23
	Tuesday	6	4	5	3	18
	Wednesday	5		7	4	16
	Thursday	3	3	4	3	13
	Friday	4	8	3	2	17
	Saturday	13		8	4	25
Table Total		50	23	35	24	132

A12 Table 17. Control Ramp Crashes: Single- or Multi-Vehicle/Crash Type.

		Analysis Period				
		BEFORE		AFTER		
		Single- or Multi-Vehicle		Single- or Multi-Vehicle		
		Single	Multiple	Single	Multiple	Table Total
Crash Type	Collision w/MV[a]	1	18		14	33
	Impact Attenuator	1		1		2
	Bridge Parapet	3				3
	Bridge Pier	1				1
	Bridge Rail	4				4
	Curb	1		2		3
	Guardrail End	1	1	5		7
	Guardrail Face	3		1	1	5
	Jacknife	1		1		2
	Median Barrier	28	2	21	5	56
	Motor Vehicle in Transit				2	2
	Other non-Fixed Object				1	1
	Non-Collision	1	1	1		3
	Other Fixed Object	5	1		1	7
	Overturn			1		1
	Traffic Sign			2		2
Table Total		50	23	35	24	132

a. MV = Motor Vehicle

A12 Table 18. Control Ramp Crashes: Single- or Multi-Vehicle/Crash Severity/Hour of Occurrence-After.

Analysis Period AFTER

		Single- or Multi-Vehicle					
		Single			Multiple		
		Crash Severity			Crash Severity		
		Fatal	Injury	Property	Injury	Property	Table Total
Crash Hour	0					2	2
	1	1					1
	2			1			1
	3			2			2
	4					1	1
	5		1	1		1	3
	6			2			2
	7		2	1	1		4
	8			1	1	1	3
	9			2		2	4
	10						
	11		2	4		1	7
	12		2			3	5
	13		1	1		1	3
	14			2	1		3
	15						
	16			1		1	2
	17				3	1	4
	18		1				1
	19			1			1
	20			2	1	2	5
	21			1			1
	22		2	1		1	4
	23						
Table Total		1	11	23	7	17	59

APPENDIX 13
Information from Japan

National Institute for Land and Infrastructure Management
1-Asahi, Tsukuba-shi, 305-0804
TEL 0298-64-2211
http://www.nilim.go.jp

31,10,02

- Title: Effectiveness of Road Markings in Curve Section
- Author: A.Kozaki, T.Fukui ; Gifu Regional Construction Office, Ministry of Construction
- Publication: 19th Japan Road Congress, 10.1991
- Type of speed reduction marking : Arrow marking type

Three patterns were settled in curves.

Pattern 1 : Delineators

Pattern 2 : Delineators and arrow markings

Pattern 3 : Delineators, arrow markings and chevron signs

- Result:

Speed reduction

Pattern 1 : Speeds of vehicles at curve starting point are high and vehicles slow down between curve starting point and middle of curve section.

Pattern 2,3 : Vehicles slow down before entrance of the curve.

Sections where effectiveness of arrow markings does not appear.

Slope sections where cars go up and slope is more than 2%.

Curve sections where radius is larger than 150m

- Title: Road Safety Countermeasures Using Road Markings
- Author: N.Takada ; Shiga Regional Construction Office, MOC
- Publication: 22th Japan Road Congress, 10.1997
- Type of speed reduction marking : Comb marking type

Speed reduction markings were settled in curves and slopes

- Results:

Average speed of vehicles were reduced between 1.6km/h and 5.7km/h.

Scattering of vehicle speeds was decreased

Speed reduction was clear at the slope (going down direction) at night.

The number of lane-change times were decreased.

National Institute for Land and Infrastructure Management
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http://www.nilim.go.jp

- Title: Effectiveness of Speed Reduction Markings for Traffic Accident
- Author: U.Kurosaki et al. ; Japan Highway Public Corporation
- Publication: 7th Annual Meeting of Japan Society of Traffic Engineers, 11,1997
- Type of speed reduction marking : Comb marking type

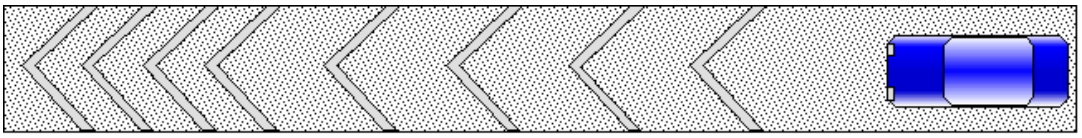
Speed reduction markings were settled at traffic accident occurring section of National Expressway

- Results:

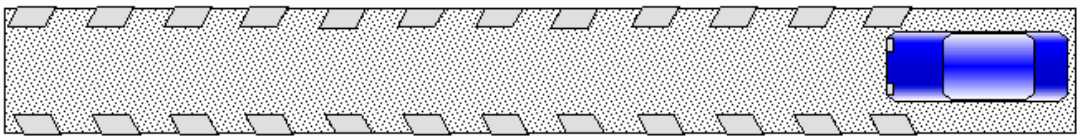
Speed reduction effectiveness is not clear.

The number of lane-change times were decreased.

Drivers felt that the lane is narrow (29%), lane change is not easy (22%) and running speed is high (10%). (Answering rate of questioners).



arrow marking



comb marking

Chevron Sign Marking (anti-skid type)

Typical anti-skid pavement install section.

This is not a good case.

Pavements have to be installed before the curve section.