"FIBEROPTIC VARIABLE MESSAGE SIGNS"

Swift Interchange - Delta Park Interchange Section Pacific Highway (Interstate 5)

Final Report Experimental Features Project OR 90-02

by

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prepared for

OREGON DEPARTMENT OF TRANSPORTATION
Salem, Oregon 97310

and

FEDERAL HIGHWAY ADMINISTRATION
Washington, D.C. 20590

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16. Abstract

The SYLVIA® fiberoptic variable message signs (VMS) were installed on the Pacific Highway (I-5) as a part of the "Swift Interchange - Delta Park Interchange" project at milepost 298.47 and at milepost 305.66 in January 1991. Initially, during project construction, the signs were used to provide road construction and delay information to the motoring public. Currently, the signs are being utilized to provide event information, and/or road delay conditions as part of the Freeway Management System.

The evaluation of the SYLVIA® fiberoptic VMS was conducted by the Oregon Department of Transportation staff as part of an Experimental Features Program research project. The issues of reliability and ease of operation were investigated. These signs have functioned well, overall. Legibility of the signs are excellent in the conditions evaluated, the maintenance requirements have been minor, and the cost of operation has been reasonable.

17. Key Words	18. Distribution Statement
TRAFFIC, CONTROL, SIGNS, MESSAGES, VARIABLE	Available through the National Technical Information Service (NTIS)

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Unclassified	Unclassified	39	

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

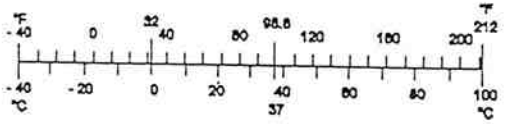
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8 + 32	Fahrenheit	°F



* SI is the symbol for the International System of Measurement

(4-7-94 jbp)

ACKNOWLEDGEMENTS

The author wishes to thank James Rusnak, Gary McNeel, Freeway Traffic Manager, Arlo Bones, Scientific Instrument Technician, Rick Wood, Transportation Operations, and the District 2B office crew for their active role in providing information used in this report. The author would also like to thank the reviewers of this report: Elizabeth Hunt, Jeff Drago, Keith Martin, Scott Nodes, and Dan Sosnovske.

DISCLAIMER

"Fiberoptic Variable Message Signs"
Swift Interchange - Delta Park Interchange Section
Pacific Highway (Interstate 5)

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1.0 INTRODUCTION

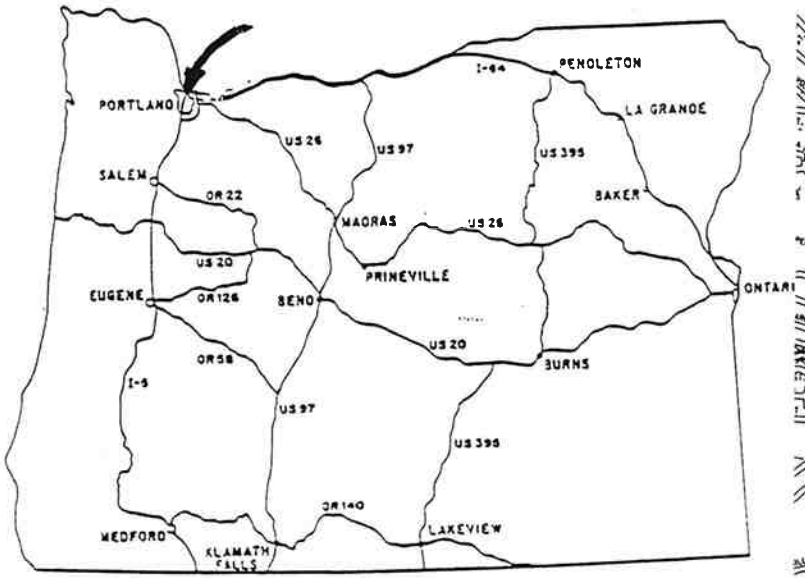
To optimize existing highway capacity and improve safety, the Oregon Department of Transportation (ODOT) is developing a Freeway Management System. A primary function of this system is to provide motorists with real-time information to help them avoid delays, to improve traffic flow and to improve safety. One viable way of providing this real-time information is with variable message signs (VMS).

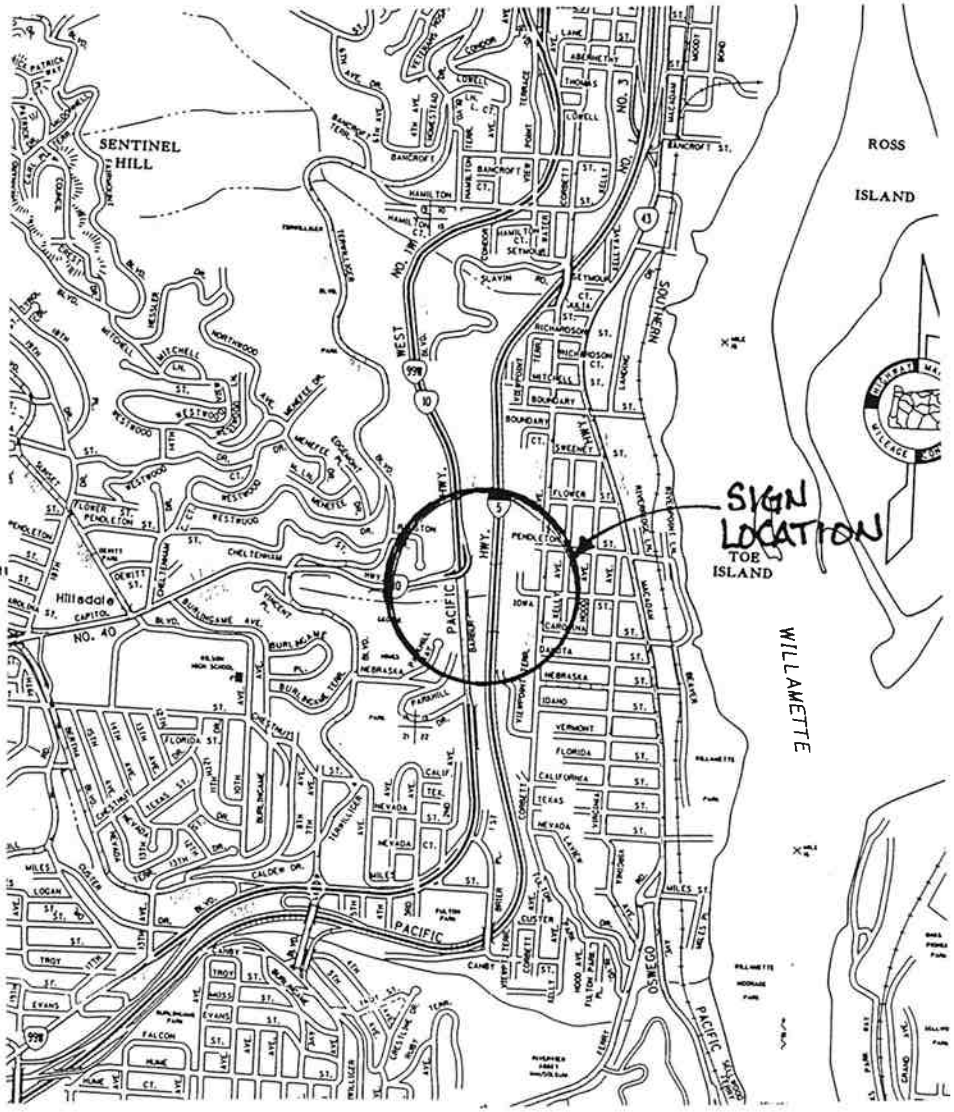
One type of VMS utilizes fiber optics. Fiberoptic VMS were installed on the Pacific Highway (I-5) at Iowa Street (see Figure 1.1) and at the Delta Park Interchange in the Portland Metropolitan area (see Figure 1.2), in January 1991. Photographs of the Delta Park Installation are included in Appendix A. Initially, the signs were placed to inform motorists of construction conditions and delays related to the "Swift Interchange to Delta Park Interchange" construction project. The fiberoptic VMS are permanent and now serve the long-term purpose of providing traffic information to drivers.

The fiberoptic message signs are the SYLVIA® Model 420 system manufactured by Fiberoptic Display Systems (FDS). The system components include the sign, the controller box, and the sign control software. These signs feature provisions for lowering and increasing light intensities to help cope with the wide range of environmental lighting conditions. Their display characters contain 35 electrically controlled shutters in a 5"x7" [130 x 180 mm] dot matrix format. Each shutter receives the ends of two fiberoptic light guides. The shutter is controlled by a short current pulse enabling free passage or masking of the light flow. The controller box is a software-oriented microprocessor with resident software installed in a non-volatile memory. The controller is capable of providing a serial interface with the central computer, controlling and monitoring the sign, and sending status reports to the central computer. Complete specifications are included in Appendix B.

The visibility of fiber optics appear to be better than bulb matrix units. A demonstration conducted in September, 1989 in Pendleton, Oregon, compared an existing 26" [660 mm] letter height bulb-matrix sign to a 3-character module from an FDS SYLVIA® Model 420 sign with an 18" [460 mm] letter height. Most observers were impressed by the legibility of the SYLVIA® unit which was legible at 1200+ feet [370 m] while the bulb-matrix sign did not become legible until 1000 feet [300 m].

The evaluation of the fiberoptic VMS was conducted by ODOT staff as part of an Experimental Features Program research project. This research project was designed to evaluate the ease of operation, reliability, maintenance requirements, visibility and the cost of the SYLVIA® Model 420 system. The information obtained from the study, will assist ODOT's traffic engineering staff in making effective decisions regarding the Freeway Management System.

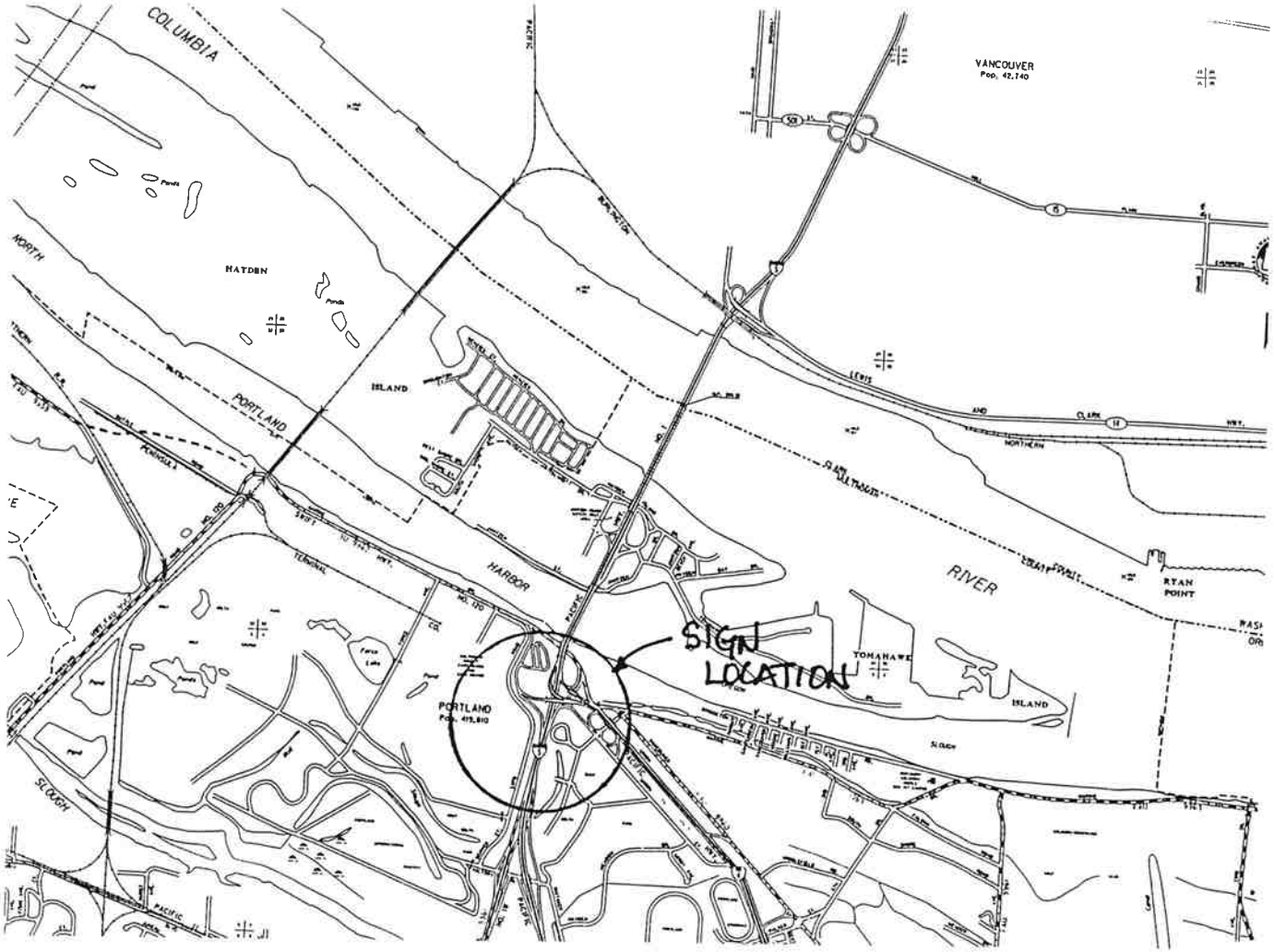




Iowa Street Vicinity Map

RESEARCH UNIT
OREGON DEPARTMENT OF TRANSPORTATION

FIGURE 1.1



Delta Park Vicinity Map

RESEARCH UNIT
OREGON DEPARTMENT OF TRANSPORTATION

FIGURE 1.2

2.0 EVALUATION

2.1 EASE OF OPERATION AND RELIABILITY

Ease of operation is a function of the software capabilities. The software provides a menu which allows the user to select options. This software is designed to run on a dedicated personal computer. After an option is selected, the computer transmits the message through a modem to the controller box. For optimal usage, the software should run continuously.

Access to data about the sign status is a concern for the users. The only way to verify the sign status after programming a sequence is to display the status table. Because the status table will not indicate that the signs are on until the sequence begins, if a delayed start is part of the programmed sequence, problems can occur. Tracking a series of communication failures is practically impossible. Although the software provides a log file of all transactions, the cause of communication failures are not identified.

Reliability is a major issue for the users of the sign because of the random communication failures. Communication between the system computer and the SYLVIA® sign has failed on several occasions. Although the cause of this failure is still under investigation, it appears to be caused by the modem failing to hang up.

2.2 MAINTENANCE

Minor maintenance has been required for the two signs. Two lamps at the Delta Park sign and four lamps at the Iowa Street sign have been replaced in the three years of operation. The lamps and separate reflector system has been changed in the vendor's new signs to an integrated bulb and reflector. The new system provides greater lamp intensity, more precisely focuses the light from the lamps and increases the life of the bulb. The vendor does have a modification kit that is available to update the lamps in the current sign.

Other maintenance problems included a shutter failure, a sign connector failure, a capacitor failure and a lamp driver failure. These problems were relatively minor and have been solved. A detailed maintenance log is included in Appendix C.

2.3 VISIBILITY

Sign visibility has been good under both day and night conditions. If the sun is shining directly on the sign face, the sign provides an overbright option. At night, a dimming option is used to reduce light bleeding. At these installations, the overbright and dimming features

have provided favorable results. In general, the signs become legible at approximately 1000 ft [300 m]. Table 2.1 provides specific information for the Iowa Street sign obtained from field evaluations under various traffic and lighting conditions.

2.4 COST OF OPERATION

Although, operating costs were the only costs evaluated, the original cost of each sign including training is shown below. The operating costs were supplied by District 2B.

The new SYLVIA® signs include an integrated bulb and reflector. As more signs are purchased, it may be advantageous to upgrade the Delta Park and Iowa Street signs to include the new bulb and reflector system. One type of bulb and reflector system for the Region, would standardize the purchase of replacement parts and insure availability. The upgrade and replacement costs were supplied by FDS.

Cost of SYLVIA® Model 420: $170,000

Average Yearly Operating Costs:

Power:	$670.00
Modem:	$840.00
Phone:	$660.00
TOTAL:	$2170.00/sign

Lamp Replacement Costs:

Lamp #64004 (2,000 hr):	$11.85
Lamp #64005 (6,000 hr):	$22.00

VMS Upgrade Costs:

Alternate 1:

Lamp modification kit:	36 x $8.00/lamp =	$288.00
Lamp #64005 (6,000 hr):	36 x $22.00/lamp =	$792.00
TOTAL:		$1,080.00/sign

Alternate 2*:

Lamp modification with two #64005 lamps: 36 x $50.25/lamp = $1809.00/sign

*Alternate 2 would provide an extra set of lamps. The cost per lamp would be $20.25: ($1809-$1080)/36 lamps. The $20.25/lamp compares to $22.00/lamp if purchased separately.

TABLE 2.1: FIELD OBSERVATIONS

Fiberoptic Variable Message Sign
I-5 @ MP 298.47, Iowa Street
Visibility Monitoring

Date	Time	Observer	Light Condition	Weather Condition	Temp.	No. of Lines	Flashing/ Steady	Legibility Distance	All messages Readable	Speed (MPH)	Traffic Operation/Notes
11/19/92	0710	R. Wood	Dark	Light drizzle, Hvy. Clouds	43°F (6°C)	3 "Sign UnderTest"	Steady	1000'+ (305 m)	Yes	35 - 40 (64 km/h)	Speed increased to 50 mph beyond sign. May have been caused by drivers reading message.
11/19/92	1752	R. Wood	Dark (Dusk)	Clear, dry	47°F (8°C)	2 "Sign Under Test"	Steady	1000'+ (305 m)	Yes	55 + (89 km/h)	No brake applications nor slowing of vehicles approaching sign.
12/3/92	0705	R. Wood	Dark	Clear, dry	29°F (-2°C)	2 "Sign Under Test"	Steady	1000'+ (305 m)	Yes	55 (89 km/h)	Traffic volume lower than usual. Accidents 8 & 9 miles prior to sign may have contributed to low volume.
2/3/93	0714	R. Wood	Morning, light - no luminaires	Clear, dry	40°F ± (4°C)	2* "Sign Under Test"	Flashing	1000'+ (305 m)	Yes	40 (64 km/h)	Large headways 2000' in advance of sign and beyond. At 2000', traffic was near stopped extending back to Capitol Hwy. Cause unknown.
2/9/93	0705	R. Wood	Morning, light - luminaires still on	Cloudy, damp pavement	40°F ± (4°C)	2** "ODOT Test Message/MP 298.3"	Steady	1000'+ (305 m)	Yes	50+ (80 km/h)	No brake applications nor slowing of vehicles approaching sign.
2/9/93	1800	R. Wood	Dark w/luminaires	Cloudy, light rain	40°F ± (4°C)	2 Same as 2/3/93	Steady	1000'+ (305 m)	Yes	65 (104 km/h)	Speed pacing vehicles in center lane. No brake applications.
2/11/93	0720	R. Wood	Low light	Cloudy, wet pavement	42°F (6°C)	2 "Sign UnderTest/ MP 298.3"	Steady	1000'+ (305 m)	Yes	35 - 40 (64 km/h)	Very heavy traffic. "Stop & Go"

TABLE 2.1 FIELD OBSERVATIONS, CONTINUED

Fiberoptic Variable Message Sign
I-5 @ MP 298.47, Iowa Street
Visibility Monitoring

Date	Time	Observer	Light Condition	Weather Condition	Temp.	No. of Lines	Flashing/ Steady	Legibility Distance	All Messages Readable	Speed	Traffic Operations/Notes
2/16/93	0700	R. Wood	Low light	Clear, dry	27°F (-3°C)	3 "Sign Under Test, Have a Nice Day, Drive Carefully"	Steady	1000'+ (305 m)	Yes	55 (89 km/h)	No noticeable affect on traffic flow. Volume somewhat lower than normal. More difficult to read than a 2-line message.
3/15/93	0708	R.Wood	Lowlight, no luminaires	Cloudy, moderate rain	45°F (7°C)	2 "Sign Under Test, Drive Safely"	Steady	1000'+ (305 m)	Water spray added difficulty	45 (72 km/h)	Speed increased from 25 mph at Terwilliger Bridge to 45 mph at end of curves and beyond sign.
8/31/93	1740	R.Wood	Bright sun	Clear, dry		3 (Message Not Documented)	Multiple panels	1000'+ (305 m)	Too much information	60+ (97 km/h)	Light traffic- high speed, short headways- I spent little time trying to read sign.
9/8/93	1720	R.Wood	Bright sun	Clear, dry	85°F (29°C)	2 (Message Not Documented)	Steady	1000'+ (305 m)	Yes	60 (97 km/h)	Smooth flow throughout section.
9/10/93	0615	R. Wood	Low sun	Clear, dry	60°F (16°C)	3 (Message Not Documented)	Steady	1000'+ (305 m)	Yes	50+ (80 km/h)	Smooth flow throughout section. Moderate volume.
9/13/93	0650	R.Wood	Sunrise, low light	Clear, dry	55°F (13°C)	2 (Message Not Documented)	Steady	1000'+ (305 m)	Yes	55 (89 km/h)	Moderate volume, free flow-no brake applications.
9/15/93	0645	R. Wood	Very low light	Heavy overcast	50°F (10°C)	2 (Message Not Documented)	Steady	1000'+ (305 m)	Yes	55 (89 km/h)	Moderate volume, some braking.
9/19/93	0845	R. Wood	Daylight	Heavy overcast, dry	55°F (13°C)	3 (Message Not Documented)	Steady	1000'+ (305 m)	Yes	60 (97 km/h)	Note-Sunday morning light traffic.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The SYLVIA® Model 420 variable message signs have functioned well. Visibility of the signs was excellent for the conditions evaluated, maintenance requirements have been minor, and operation costs are reasonable.

If VMS are needed, ODOT traffic engineering staff should consider using the SYLVIA® Model 420. Modifications to the software, however, are recommended prior to future purchases. The software modifications recommended include:

1) The software should be updated to run in a Windows® environment.
2) Access to sign status information should be easily available.
3) Causes of failure should be identifiable.

In addition, we recommend that the lamps be upgraded, as needed, with the vendor's modification kit.

Fiberoptic Display Systems' also has provided recommendations that are included in Appendix D.

APPENDIX A

Variable Message Sign at Delta Park Interchange:

APPENDIX B

FIBEROPTIC DISPLAY SYSTEMS, INC.
1 Thurber Boulevard
Smithfield, RI 02917 U.S.A.
(401) 232-3370 FAX (401) 232-7130

An S.E.S. Company

Patent 4.794.391

SYLVIA technical leaflet

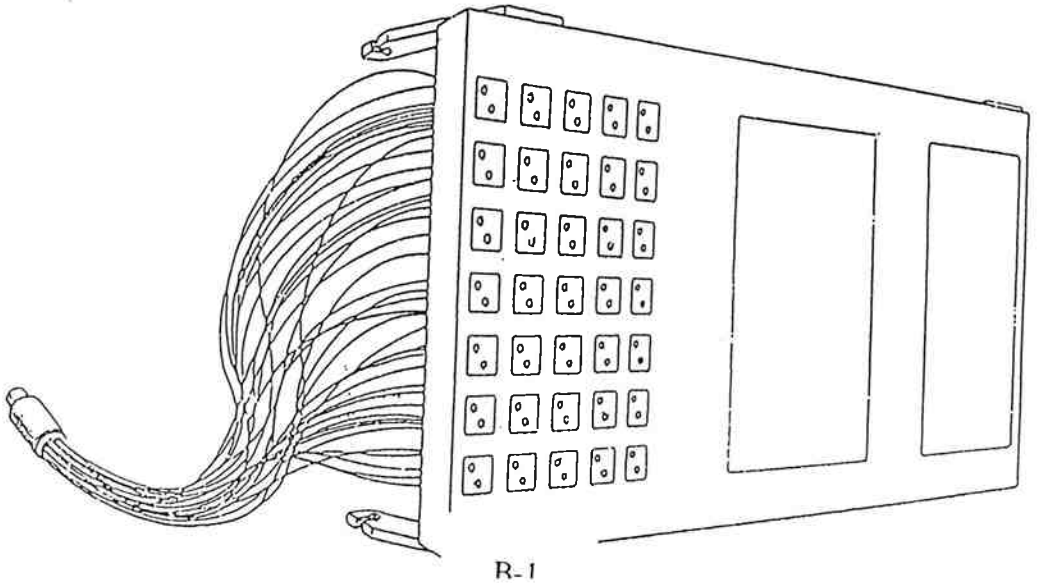
DISPLAY MODULES

SYLVIA display characters contain 35 electrically controlled shutters in a 5 X 7 dot matrix format. Each shutter receives the end of two fiberoptic light guides.
The shutter is controlled by a short current pulse enabling free passage or masking of the light flow. An inherent magnetic memory in each shutter retains the display indefinitely with no control power.

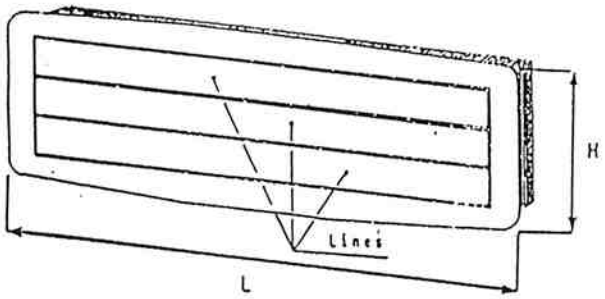
The 12.5 inch display characters (series 320) and 18-inch display characters (series 420) are ideal for changeable message signs (CMS) on roads and freeways, to provide the driving public with timely information about road conditions ahead.

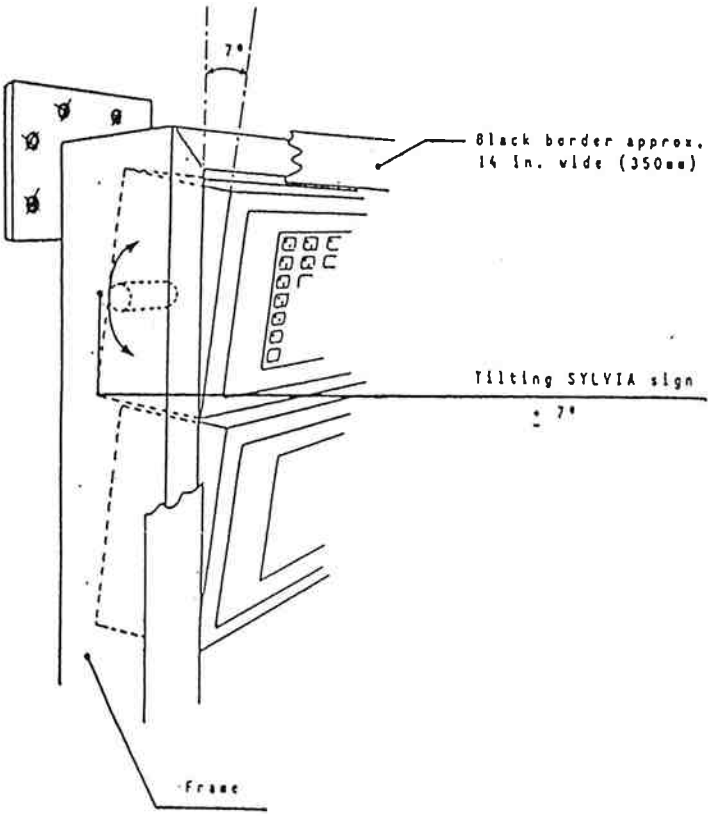
BENEFITS :

* Superior visibility and legibility under all weather conditions.
* Dimming of the light source to avoid any dazzle in low ambient light.
* Functional test or passage from a message to another without visual disturbance (lamps are turned off during the updating process).
* Writing speed better than 60 characters per second.
* Flashing messages, alternate messages.
* Low energy consumption.
* Proven performance and reliability with over 100 systems operational.



SYLVIA BOARD : GENERAL SPECIFICATIONS





The SYLVIA sign consists of a frame and of one to four lines of 12, 15 or 18 characters series 320 or series 420 (maximum 64 characters).

Frame :

Made of welded aluminum alloy, the frame allows :

- mounting and tilting of the lines,
- mounting of the SYLVIA sign to a support structure (sign bridge, cantilever or post),
- mounting of a maintenance catwalk behind the sign. (option)

A matte black border is mounted on the frame to enhance readability

Lines :

- Structure made of welded aluminum alloy,
- Housing envelope made of anodized aluminum ., bolted to the structure,
- Sign face made from 1/4 in. methacrylate with antiglare device . Modules are removable with no tools required.
- 3 Character modules, including fiberoptic system and lighting module,
- Rear access doors for service and inspection, equipped with gas struts. Front access is an available option.

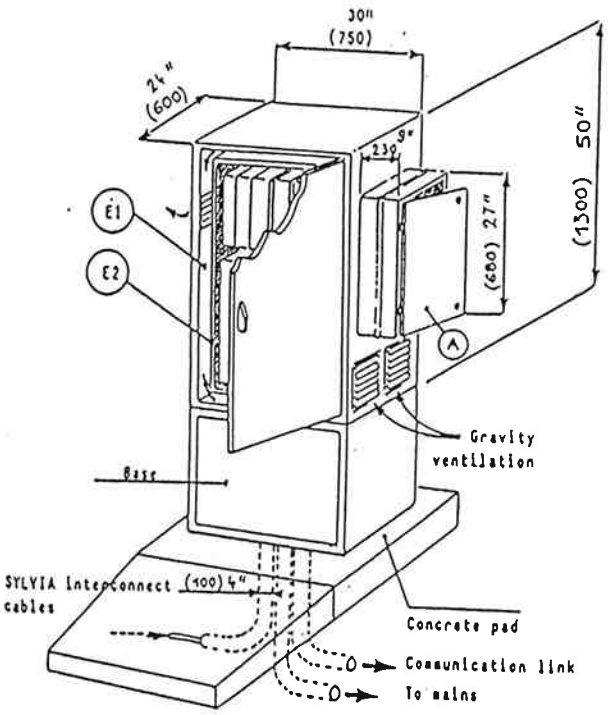
Each line (or group of lines) includes an adjustment device (+ - 7°) which allows optimal tilting of the sign with regard to the site configuration.
The sign has been designed to withstand wind pressures of 1600 Pa and to operate over an ambient temperature range of -25 to +45° C without heating or forced air cooling.
Thermostatically controlled heating of the sign face is a advisable option in cold climates to prevent fogging of the sign face.

DIMENSIONS (APPROX.)

SYLVIA	NUMBER OF LINES	12 CHARACTERS				15 CHARACTERS				18 CHARACTERS			
		WEIGHT lbs.	L	H	WEIGHT catwalk	WEIGHT lbs.	L	H	WEIGHT catwalk	WEIGHT lbs.	L	H	WEIGHT catwalk
12.5" 320	1	1150	17'1"	5'7"	375	1350	20'8"	5'7"	440	1520	23'8"	5'7"	520
	2	1570	17'1"	7'8"	375	1870	20'8"	7'8"	440	2130	23'8"	7'8"	520
	3	2000	17'1"	9'8"	375	2370	20'8"	9'8"	440	2750	23'8"	8'8"	520
	4	2420	17'1"	11'5"	375	2880	20'8"	11'5"	440				
18" 420	1	1710	22'3"	8'4"	430	2010	28'10"	8'4"	570	2200	31'4"	8'4"	870
	2	2310	22'3"	8'4"	430	2730	28'10"	8'4"	570	3150	31'4"	8'4"	870
	3	2890	22'3"	10'10"	430	3455	28'10"	11'6"	570	3680	31'4"	11'6"	870
	4	3520	22'3"	13'7"	430	4200	23'10"	14'01"	570				

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

CONTROL CABINET



DIMENSIONS IN BRACKETS ( ) ARE IN MILLIMETERS

The maximum interconnect cables length is 100 ft (30 m).

Double-enclosure type (E1) (E2) insuring IEC 55 degree (Nema 3) of protection with lamps supply transformer.

SPECIFICATIONS :

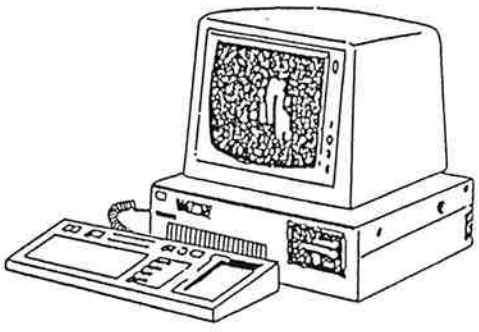
* 115 V ± 10% 60 Hz
  single phase
* Power consumption inside the control cabinet : 500W max.
  (not including sign lamps - see "Fiberoptic system" - and maintenance outlets).
* Weight 370 lb (170 kg) approx.
* Main power supply and distribution
* Sign lamps supply
* Controller
* Communication interface.
* Accessories (internal lighting, internal heating, maintenance outlets...)

The controller is software-oriented microprocessor type with resident software furnished and installed in non-volatile memory.

The controller is capable of providing :

* RS 232 C serial interface for communication with a Central Control Computer,
* Control and monitoring of the sign,
* Sending of status reports to the Central Control Computer.

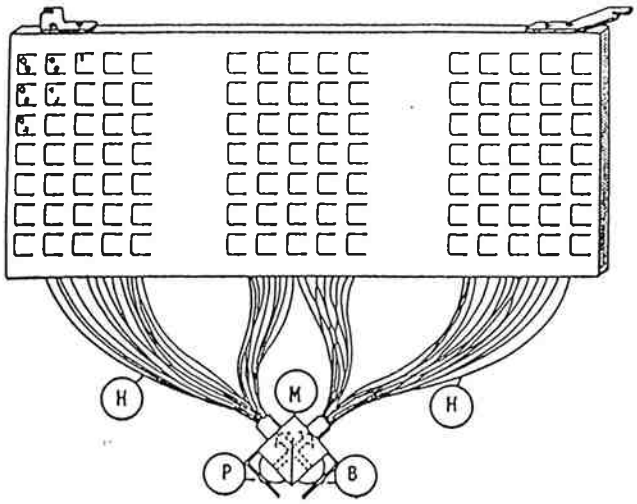
..... SYLVIA ..... CENTRAL CONTROL SYSTEM .....



The central computer system runs on any IBM or fully compatible personal computer under MS.DOS. The software has an user friendly interface and a context sensitive help and features :

* Control of up to 35 signs on private, leased, dial-up lines or via cellular phone.
* Storage of up to 12000 messages.
* Programmable sequences over a week.
* Operator log-in with password protection and individual access rights.
* Monthly log files.

FIBEROPTIC SYSTEM



One lighting module (M) feeds 2 fiberoptic harnesses (H)
Each one consisting of 105 glass fiber bundles protected by PVC jacketing;

Each lightguide end is fitted with a convergence cone.

The cone widens the dot and increases intensity axially.

Three display characters are operated using one lamp (P)
In the overbrightness mode both the primary and backup lamps are employed for added punch (sun directly into the sign face situation).

(H) = Fiberoptic harness (105 bundles)

(M) = Lighting module mounted on vibration absorbing platform

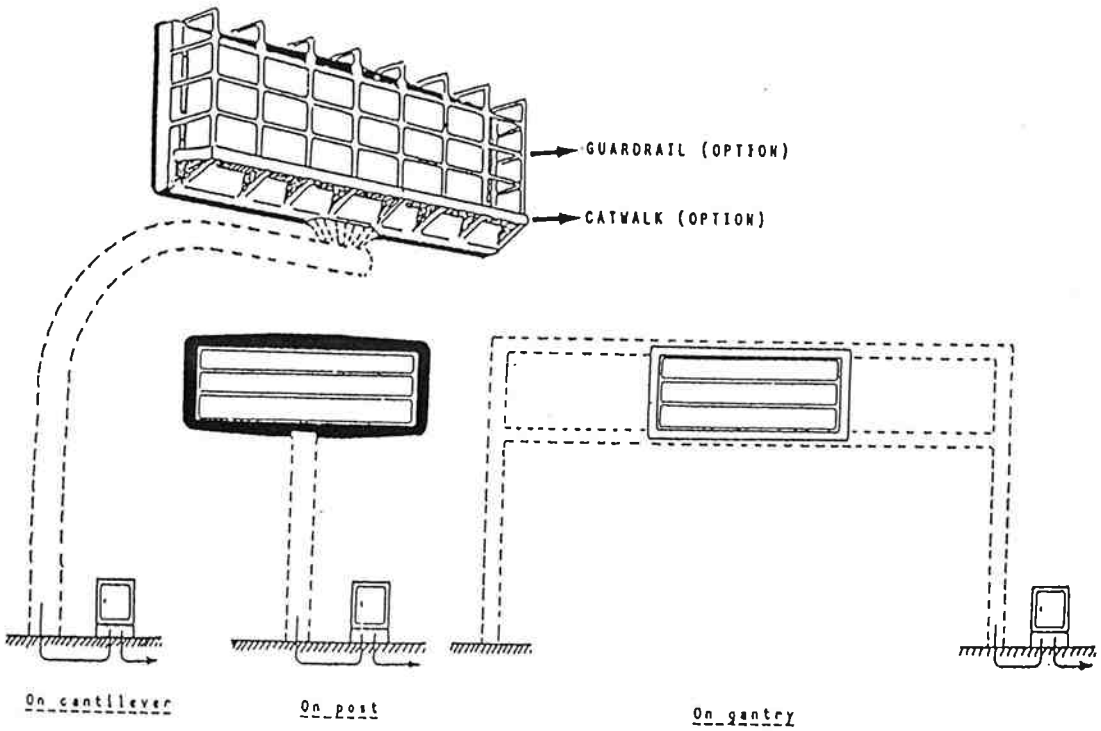
(P) (B) = Primary and back-up lamps 10V 50W (6000 hours)

POWER CONSUMPTION

OPERATING CONDITIONS	LAMPS VOLTAGE	1 LINE SYLVIA 320 OR 1 LINE 420		
		12 charact.	15 charact.	18 charct.
Day	10 V	250 W	315 W	375 W
Night	4.5 V	80 W	100 W	120 W
Overbright	10 V	500 W	630 W	750 W

NOTE : These figures do not include sign heating option.

..... SYLVIA ..... EXAMPLES OF INSTALLATIONS .....



Supports must be designed to enable access to the inspection doors located at the back of the housings, unless front opening is required.

APPENDIX C

@x

TO: KAREN HOFFMAN
RESEARCH UNIT
O.D.O.T.
986-2851

FROM: ARLO BONES
SCIENTIFIC INSTRUMENT TECH.
T.S.S.U.
O.D.O.T.
PORTLAND
257-4396

ENCLOSED IS THE REPORT ON THE DELTA PARK AND IOWA VARIABLE MESSAGES SIGNS IN PORTLAND.

SUBJECTS INCLUDE THE FOLLOWING:
DELTA PARK VARIABLE MESSAGE SIGN MAINTENANCE LOG
IOWA VARIABLE MESSAGE SIGN MAINTENANCE LOG
SUMMARY OF FAILURES
OBSERVATIONS
RECOMMENDATIONS
VENDOR RECOMMENDATIONS

CC: JEF DRAGO, TRAFFIC, SALEM
GEORGE SACKINGER, TRAFFIC, SALEM
GARY McNEEL, TRAFFIC OPERATIONS, PORTLAND
MEL MAKIN, TRAFFIC SIGNAL SERVICES UNIT, SALEM

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DELTA PARK VARIABLE MESSAGE SIGN MAINTENANCE LOG

OCTOBER 12, 1992

CHECKING INTERSTATE BRIDGE SETUPS AFTER FINDING PROBLEMS COMMUNICATING WITH MY LAPTOP COMPUTER TO THE DELTA PARK VARIABLE MESSAGE SIGN. CHANGED CALL OUT TRIES FROM 3 TO AN EVEN NUMBER 4. INCREASED THE TIME BETWEEN REDIAL TRIES FROM 10 SECONDS (DELTA PARK DID NOT HAVE ENOUGH TIME TO HANG UP TROUGH THIS PHONE EXCHANGE) TO 20 SECONDS.

1993

ELECTRICAL REPLACED ONE LAMP.

DECEMBER 2, 1993

CHECKING ONE SHUTTER COLUMN ON ONE LETTER SECTION OF THE SIGN. IT HAD FAILED TO WORK CORRECTLY TWICE. THE FIRST TIME IT CURED ITSELF. THE PINS WERE INTERMITTENT WHEN THE CABLE CONNECTOR WAS MOVED. THE CONNECTOR AND PINS LOOK GOOD. THERE IS PROBABLY CONTAMINATION IN THE CONNECTOR. REMOVING AND REINSTALLING THE CONNECTOR CURED THE PROBLEM.

APRIL 1, 1994

THE ELECTRICAL CREW REPLACED A LAMP IN THE SIGN, AND THE MONITORING STATUS INDICATED THAT THE LAMP WAS STILL ON THE BACK UP LAMP. THE LAMP STATUS CHART WAS O.K.. I HAD TO RESET THE DELTA SIGN ELECTRONICS WITH THE COMPUTER TO CLEAR IT.

AUG. 17, 1994

NO FURTHER FAILURES

IOWA VARIABLE MESSAGE SIGN MAINTENANCE LOG

MARCH 15, 1991
COMPLAINT RECEIVED WAS UNABLE TO CALL SIGN.
MODEM WAS OFF HOOK. POWER TO MODEM WAS TURNED OFF AND THEN ON TO RESET MODEM. IT RAN.

MARCH 26, 1991
JEFF DRAGO REQUESTED THE CENTRAL PROCESSOR MODULE (MUC) BOARD BE REPLACED PER THE MANUFACTURES RECOMMENDATIONS. REPLACED THE BOARD. TESTED O.K.
NO FEEDBACK WAS RECEIVED AS TO WHAT WAS WRONG WITH THE BOARD.

APRIL 1, 1991
WITH JEFF DRAGO REPLACED TWO SHUTTER CONTROL MODULE (MCO) BOARDS. SIGN WORKING O.K.
NO FEEDBACK WAS RECEIVED AS TO WHAT WAS WRONG WITH THE BOARD.

NOV. 21, 1991
COMPLAINT: CANNOT COMMUNICATE TO SIGN.
FAILURE VERIFIED.

1. CHANGING MODEMS WITH 2400 BAUD SPARE AND THE 2400 BAUD MODEM REMOVED FROM THE DELTA PARK VARIABLE MESSAGE SIGN PRODUCED VARIOUS SYMPTOMS BUT NO FIX.
2. USING MY PHONE THE PHONE LINE WAS WEAK ON RECEIVE. CALLED THE PHONE COMPANY AND THAT NIGHT THEY FOUND SOMETHING WRONG ON THE LINE AND DISPATCHED A MAINTENANCE PERSON TO THE SITE AND FOUND NOTHING.

NOV. 22, 1991
BEFORE CALLING THE PHONE COMPANY OUT AGAIN, CONTINUED TO INVESTIGATE.

1. FOUND THAT A SIGN POST AND CONCRETE HAD BEEN PUT IN LINE WITH THE ELECTRICAL AND PHONE LINE CONDUITS COMING FROM THE SERVICE AND PHONE LINE BOX. CHECKED OUT ALL OF THE PHONE LINES AND THEY HAVE THE CORRECT RESISTANCE FOR THE LENGTH OF CABLE.
2. CHANGED THE CABLE USED FROM THE TERMINATION BOX TO THE MODEM IN THE VARIABLE MESSAGE SIGN CABINET TO THE SECOND CABLE.
3. CALLED THE PHONE COMPANY BACK OUT AND THEY PUT THEIR TEST EQUIPMENT ON THE LINE AND VERIFIED THAT THEY WERE SUPPLYING THE PROPER SIGNAL LEVEL TO THE CABINET. IT SHOULD BE NOTED THAT WHEN THE MODEM FAILS TO HANG UP IN TIME, THE OFF HOOK WARNING TONE MAY BE HOLDING THE MODEM ON LINE.
4. PUT A HAYES 1200 BAUD MODEM IN INSTEAD OF THE 2400 BAUD MODEM. THE 2400 BAUD MODEM HAS SOFT SET UPS WHILE THE 1200 BAUD IS SWITCH SELECTABLE. COMMUNICATIONS AND SIGN WORKING.

[illegible]N. 29, 1992
[illegible]ER NO PROBLEMS USING THE 1200 BAUD MODEM, THE VENDOR [illegible]ALLED THE 2400 BAUD MODEM AND SET THE SIGN COMMUNICATIONS BAUD. THE COMMUNICATION RATE WAS 1200 BAUD PREVIOUSLY.
[illegible]R ALSO REINSTALLED THE CABLE NOTED ON NOV. 22, 1991,

FEB. 28, 1992
UNABLE TO COMMUNICATE TO SIGN
MODEM INDICATIONS ARE O.K. VERIFIED SIGN MODEM WOULD ANSWER.
NO FURTHER COMPLAINT RECEIVED.

AUG. 5, 199X2
AT THE RECOMMENDATION OF THE VENDOR TO PREVENT COMMUNICATION PROBLEMS, THE CABLE FROM THE SIGN CONTROLLER TO THE MODEM WAS MODIFIED. THE CONNECTOR PINS 18 AND 23 WERE DISCONNECTED ON THE CABLE AT THE MODEM END. WHEN TESTED IT FAILED. THE INTERSTATE BRIDGE COMPUTER MODEM SHOWED IT WAS SENDING DATA AT THE CORRECT BAUD RATE BUT NO DATA WAS BEING RECEIVED BY THE MODEM LED AT THE SIGN. THE WIRES THAT HAD BEEN DISCONNECTED WERE RECONNECTED AND THERE WAS NO CHANGE IN RESULTS. DURING TROUBLE SHOOTING THE SIGN MODEM RECEIVE DATA LED WOULD SOME TIMES INDICATE DATA WAS BEING RECEIVED BUT NO TRANSMIT DATA LIGHT. CONNECTED AN RS232 LED CABLE TESTER AND HAD THE SAME RESULTS. DURING THE TESTING THE CONTROLLER WAS POWERED DOWN SEVERAL TIMES BUT STILL DID NOT SEEM TO CURE THE PROBLEM. PUT IN A DIFFERENT PHONE LINE FROM THE TERMINAL BOX IN THE CONTROLLER CABINET TO THE MODEM. THIS IS THE SAME LINE RECONNECTED JAN. 23, 1992, ITEM 2.

THE CAUSE MAY BE EITHER THE CABLE RECONNECTED ON JAN. 23, 1992, OR SOMETHING TO DO WITH POWER UP RESET OF THE CONTROLLER.

THE CONNECTOR MODIFICATION WAS DONE BEFORE LEAVING AND WORKED.

A SINGLE DOT WAS NOTICED ON THE SIGN WITH THE TEST SIGN MESSAGE. THIS PROBLEM HAS NOT BEEN LOOKED INTO YET.

NOTE: BOTH THE LAWNFIELD AND THE INTERSTATE BRIDGE COMPUTER LOCATIONS HAVE HAD THEIR MODEMS FAIL TO HANG UP PREVENTING THE OTHER FROM CALLING THE SIGN.

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IOWA VARIABLE MESSAGE SIGN MAINTENANCE LOG

OCTOBER 12, 1992

CHECKING THE INTERSTATE BRIDGE SETUPS AFTER HAVING COMMUNICATIONS PROBLEMS WITH MY LAPTOP AND THE DELTA PARK VARIABLE MESSAGE SIGN. CHANGED THE CALL OUT TRIES FROM 3 TO AN EVEN NUMBER 4. INCREASED THE TIME BETWEEN REDIAL TRIES FROM 10 SECONDS (DELTA PARK DID NOT HAVE ENOUGH TIME TO HANG UP THROUGH THIS PHONE EXCHANGE) TO 20 SECONDS.

OCTOBER 13, 1992

CHECKING THE SIGN BY CONNECTING TO THE SIGN ELECTRONICS. ONE SHUTTER IS STAYING OPEN SHOWING AN EXTRA DOT. THE EXTRA DOT CURED IT'S SELF BY FEB. 16, 1993.

OCTOBER 14-15, 1992

HAVING TROUBLE GETTING SIGN COMMUNICATIONS REESTABLISHED AFTER HOOKING LAPTOP DIRECTLY TO THE SIGN ELECTRONICS. THIS IS A REOCCURRING PROBLEM AT IOWA STREET SIGN. DISCOVERED THAT IF THE MODEM POWER IS TURNED ON FIRST AND THEN THE SIGN ELECTRONICS POWER, COMMUNICATIONS WILL BE OK AFTER DISCONNECTING AND REHOOKING UP THE MODEM.

OCTOBER 23, 1992

AFTER NOTICING THERE IS GARBAGE ON THE PHONE LINE AFTER THE 2400 BAUD MODEM HANGS UP, I TRIED COMMUNICATIONS WITH THE MODEM AT 1200 BAUD AND THE GARBAGE WAS STILL THERE.

NOVEMBER 23, 1992

IOWA PHONE LINE IS BUSY. INTERSTATE BRIDGE MODEM IS ON LINE TO IOWA STREET. OH AND CD LIGHTS ARE LITE ON THE INTERSTATE BRIDGE MODEM. RESETTING MODEM CURED PROBLEM.

JANUARY 5, 1993

PHONE LINE DATA IS GARBAGE. MODEM AT IOWA STREET IS AT 1200 BAUD. TURNING THE MODEM POWER OFF AND ON PUT IT BACK TO 2400 BAUD (THE ONLY OPTIONAL SPEED BY THE SIGN COMPUTER PROGRAM). NO MORE GARBAGE.

FEBRUARY 16, 1993

KENNETH BENEVIDES FROM FIBEROPTIC DISPLAY SYSTEMS, INC., ADJUSTED THE TAPS ON THE LAMP POWER TRANSFORMER. AC POWER UNDER FULL LOAD IS 105.8 VAC, STILL TOO LOW. KEN REWIRED THE RELAY THAT SUPPLIES POWER TO THE SIGN LAMPS DUE TO A PROBLEM THEY FOUND ELSEWHERE. THE STUCK SHUTTER FROM OCT. 13, 1992 HAS CURED IT'S SELF. KEN CHECKED PHONE POLARITY AND IT WAS O.K.. KEN WAS NOT SURE WHAT TO

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DO ABOUT THE CONTINUING INTERMITTENT TEMPERATURE READING PROBLEM.

AUGUST 27, 1993

PUT IN NEW TEMPERATURE SENSOR ELECTRONICS SUPPLIED BY FDS. TEMPERATURE STILL BAD. INTERMITTENT.

SEPTEMBER 3, 1993

AT SIGN AT TIME OF ACTUAL TEMPERATURE FAILURE. MOVING THE TEMPERATURE SENSOR POLE, THE TEMPERATURE WAS O.K.. LOWERED POLE AND TIGHTEN LOOSE CONNECTIONS. TIE WRAPS TOO TIGHT.

MEASURED AC POWER. AC NEUTRAL TO HOT IS 115 VAC. GROUND TO NEUTRAL IS 5 VAC.

SEPTEMBER 7, 1993

TEMPERATURE BAD AT COLDER TEMPERATURES AND WHEN THERE IS DEW.

SEPTEMBER 13, 1993

REPLACED THE ADC BOARD. NOTICED WHEN THE MEP BOARD WAS PULLED, THAT CAPACITOR C44 ON THE MUP BOARD WAS BURNT. C44 IS A DECOUPLING CAP OF WHICH THERE ARE MANY ON THE BOARD WHICH SHARE THE SAME ELECTRICAL POINTS. C44 IS THE ONLY ONE WHICH IS SUPPOSE TO BE PUT INTO THE BOARD THE OPPOSITE DIRECTION OF THE OTHERS. IF C44 WAS PUT IN WITH THE POLARITY DIRECTION AS THE OTHERS, THEN THIS FAILURE IS CONSISTENT WITH A DC VOLTAGE REVERSAL FAILURE FOR THIS TYPE OF CAPACITOR. THE MEP BOARD SHOWED HEATING FROM THIS COMPONENT BUT DID NOT CAUSE ANY DAMAGE. CLIPPED C44 OFF THE MUP BOARD.
AT THE VENDORS REQUEST I DID MORE TESTING OF THE PROBLEM OF POWERING BACK THE SYSTEM AFTER HAVING THE LAPTOP DIRECTLY CONNECTED TO THE SIGN ELECTRONICS.

1. IF THE MODEM POWER IS TURNED ON AFTER THE SIGN ELECTRONICS THERE WILL BE A COMMUNICATION FAILURE.
2. IF THE MODEM POWER IS TURNED ON BEFORE THE SIGN ELECTRONICS, THE COMMUNICATIONS WILL WORK.
3. IF THE MODEM AND SIGN ELECTRONICS IS TURNED ON AT THE SAME TIME USING A COMMON CIRCUIT BREAKER, THE COMMUNICATIONS WILL WORK.

SEPTEMBER 14, 1993

TEMPERATURE READING ARE FAILING AGAIN.

SEPTEMBER 16, 1993

REPLACED THE MEP BOARD AND ALL PIGGY BACK BOARDS. REPLACED C44 ON THE MUP BOARD. TEMPERATURE READINGS ARE O.K. AGAIN.

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SEPTEMBER 30, 1993

PUT THE IOWA STREET MEP BOARD AND ALL THE PIGGY BACK BOARDS IN AT DELTA PARK VARIABLE MESSAGE SIGN. TEMPERATURE O.K..

OCTOBER 28, 1993

TEMPERATURE FAILED AT DELTA. REPLACED TWO PIGGY BACK BOARDS ON THE MEP BOARD. STILL WORKING AS OF AUG. 17, 1994.

NOVEMBER 22, 1993

PUT THE OLD TEMPERATURE SENSOR ELECTRONICS BACK IN. STILL WORKING AS OF AUG. 17, 1994.

DECEMBER 1, 1993

A TOTAL OF FOUR PRIMARY LAMPS HAVE GONE BAD IN ABOUT MONTH'S PERIOD. BACK UP LAMPS FUNCTIONED WELL.

DECEMBER 2, 1993

ELECTRICAL REPLACED THE FOUR LAMPS. ONE OF THE SIGN LAMPS UNITS WOULD NOT GO BACK TO THE PRIMARY LAMP BUT STAYED ON THE BACK UP LAMP. THE LAMP WAS VERIFIED TO BE GOOD.

DECEMBER 13, 1993

NO COMMUNICATIONS AT IOWA SIGN. INSTRUCTED THE ELECTRICIAN TO TURN POWER OFF TO BOTH THE SIGN ELECTRONICS AND THE MODEM AND REAPPLY AT THE SAME TIME USING THE COMMON CIRCUIT BREAKER. COMMUNICATIONS CAME BACK UP.

AT THE SITE I REPLACED THE FIRST LAMP DRIVER BOARD WITH A SPARE AND NOW ALL PRIMARY LAMPS ARE ON. BACK AT THE SHOP I TROUBLESHOT THE BOARD AND FOUND THE COIL FOR DETECTING LAMP CURRENT HAD A POOR SOLDER JOINT AND FIXED IT.

FEBRUARY 1994

THE ELECTRICAL CREW RESPONDED TO A COMMUNICATION PROBLEM. THEY TURNED THE POWER OFF. THE POWER OF THE SIGN ELECTRONICS AND MODEM WAS APPLIED AT THE SAME TIME AND COMMUNICATIONS WAS THEN O.K..

JUNE 6, 1994

LAWNFIELD WAS UNABLE TO COMMUNICATE TO THE IOWA SIGN. I CALLED WITH MY LAPTOP AND WAS ABLE TO COMMUNICATE TO THE SIGN. LAWNFIELD TRIED AGAIN AND WAS ABLE TO GET THE SIGN ON THE SECOND TRY. THIS IS CONSISTENT WITH THE OLDER PROGRAM I AM USING ON MY LAPTOP. WHEN YOU FIRST ACCESS THE SYLVIA PROGRAM AND ATTEMPT TO CALL A SIGN, THE FIRST TRY WILL NOT WORK, BUT THE SECOND TRY WILL AND ALL OTHER TRIES WILL WORK. IF YOU LEAVE THE PROGRAM, THEN

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THE FIRST TRY WILL FAIL AFTER REENTERING THE PROGRAM.

AUG 17, 1994

NO FURTHER FAILURES.

SUMMARY

LAMP FAILURES

THERE ARE A TOTAL OF 18 PRIMARY AND 18 BACKUP LAMPS.

THE IOWA SIGN LOST 4 PRIMARY LAMPS. THE FAILURES WERE CLOSE TOGETHER (DEC., 1993). DUE TO THE CLOSE GROUPING OF THE FAILURES, THEY MAY BE CAUSED BY A POWER SOURCE OCCURRENCE INSTEAD OF A LIFE EXPECTANCY FAILURE.

THE DELTA PARK SIGN LOST 2 PRIMARY LAMPS SPACED FAR APART.

THE IOWA SIGN WAS USED MORE THAN THE DELTA PARK SIGN.

SHUTTER FAILURES

THE IOWA SIGN HAD ONE SHUTTER WHICH STUCK OPEN BUT THE PROBLEM WENT AWAY.

SIGN CONNECTOR FAILURES

DELTA PARK HAD A COLUMN OF A LETTER WHICH WAS BLANK. THE PROBLEM WENT AWAY AND RETURNED. CHECKING ON THE SECOND OCCURRENCE THE CONNECTOR WAS INTERMITTENT. REMOVING AND REINSTALLING THE CONNECTOR CURED THE PROBLEM. THIS WAS A TYPICAL FAILURE OF CONTAMINATION BETWEEN THE PIN AND WIPER. CLEANING USING A CONTACT CLEANER CHEMSEARCH LEXITE WOULD BE RECOMMENDED.

THE VENDOR HAS CHANGED THE CONNECTOR DESIGN ON THEIR NEW SIGNS.

MUP BOARD CAPACITOR C44 FAILURE

THE IOWA SIGN MUP BOARD C44 BURNT. C44 WAS PROBABLY INSTALLED REVERSED.

THE DELTA PARK, THE IOWA SIGNS, AND THE PORTLAND SPARES WERE CHECKED FOR THE REVERSAL OF THE COMPONENT AND NONE WERE FOUND.

SUGGEST THAT THE REGION 5 SIGN BOARDS AND SPARES BE CHECKED.

LAMP DRIVER BOARD---BAD SOLDER JOINT FOR COIL DETECTING LAMP CURRENT

IOWA SIGN HAD ONE FAILURE AND WAS CORRECTED.

SUGGEST ALL OF THE BOARDS BE INSPECTED AND RESOLDER IF NECESSARY.

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COMMUNICATION FAILURES

LINE BUSY

LAWNFIELD OR INTERSTATE BRIDGE COMPUTERS FAILED TO HANG UP AFTER CALLING SIGN.

LINE BUSY

AFTER CALLING A SIGN ONCE (DELTA PARK) THE COMPUTERS SECOND CALL GETS A BUSY SIGNAL. THERE WAS NOT ENOUGH TIME BETWEEN THE CALL OUTS FOR THE PHONE EXCHANGES TO HANG UP. CURE WAS TO INCREASE THE WAITING TIME BETWEEN CALL OUTS.

NO CONNECT

COMPUTER SYLVIA SOFTWARE FAILS TO CONNECT ON THE FIRST TRY AFTER STARTING SYLVIA.EXE. WORKS ON SECOND CALL AND ALL FURTHER CALLS. CALL OUT TRIES TO BE SET TO A MINIMUM OF TWO.

FAILURE TO COMMUNICATE AFTER A LAPTOP COMPUTER HAS BEEN CONNECTED TO THE SIGN ELECTRONICS. (NOTE: THE VENDOR HAS HAD THIS PROBLEM AT OTHER SIGN LOCATIONS TOO).

CURE:

1. TURN POWER OFF TO SIGN ELECTRONICS AND MODEM
2. RECONNECT MODEM
3. TURN THE POWER ON TO THE MODEM AND THE ELECTRONICS AT THE SAME TIME

OR

3. TURN THE POWER ON TO THE MODEM FIRST AND THEN TURN THE POWER ON FOR THE ELECTRONICS SECOND.

FAILURE TO COMMUNICATE

REASON UNKNOWN------RESET AS ABOVE.

FAILURE GARBAGE FOR DATA

ONE FAILURE AT THE IOWA SIGN------MODEM AT SIGN IS 1200 BAUD INSTEAD OF 2400 BAUD. RESET MODEM AT SIGN.

AC POWER

THE AC POWER TO THE ELECTRONICS CABINET IS STILL A PROBABLE CONTRIBUTING FACTOR IN THE COMMUNICATION FAILURES AND THE REQUIREMENT OF NEEDING TO RESET THE IOWA SIGN.

FAILURE TEMPERATURE READING

THE IOWA SIGN TEMPERATURE READING FAILURE WAS TRACED TO ONE OF TWO PIGGY BACK BOARDS, OF THE TWO BOARDS ONE WAS INTERMITTENTLY HOLDING ONE DATA BIT AT THE WRONG LOGIC STATE.

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OBSERVATIONS

LAMP INTENSITY AFTER REPLACEMENT DID NOT APPEAR TO BE MUCH DIFFERENT THAN THE OLDER BULBS STILL IN THE SIGN. IF ANY DIFFERENCE, A BIT LESS BRIGHT THAN THE OLD ONES.

THE INSIDE OF THE SIGNS LOOKED CLEAN WITH NO OBVIOUS MILDEW.

NO PREVENTIVE MAINTENANCE HAS BEEN PERFORMED IN ORDER TO TEST HOW THE SIGN PERFORMS DURING THE STUDY PERIOD. IF THE STUDY IS COMPLETED, THEN WE WILL NEED TO DECIDE WHAT ROUTINE MAINTENANCE IS REQUIRED AND HOW OFTEN.

THE CURRENT LAMPS AND REFLECTORS HAVE BEEN CHANGED IN THE VENDORS NEW SIGNS. I CALLED THE VENDOR ON AUG 29, 1994 ON THE AVAILABILITY OF THE CURRENT LAMPS AND THEY ARE AVAILABLE AND ARE STILL BEING MANUFACTURED. I HAVE ENOUGH IN STOCK TO RELAMP ALL OF THE PORTLAND PRIMARY LAMPS. CONSIDERING THE LONG LIFE OF THESE LAMPS THERE IS NO HURRY TO CHANGE THE SIGNS TO THE NEW LAMP MODIFICATION KITS. I WOULD RECOMMEND MODIFYING ONE SIGN AT A TIME SO THE BACKUP LIGHTS OF ONE COULD BE USED IN THE OTHER SIGN. PLEASE NOTICE THE HIGHER COSTS OF THE NEW LAMP (SEE VENDOR RECOMMENDATIONS) VERSUS THE CURRENT LAMP AT $9.75.

TALKING WITH KEN BENEVIDES FROM FDS, HE BROUGHT TO MY ATTENTION THAT THE SIGN COMPUTER HAS BEEN CHANGED ON THE NEW SYSTEMS. WHEN WE FIRST STARTED TO EVALUATE FDS'S SIGNS ORIGINALLY, THE COMPUTER WAS A TYPE FOR WHICH WE HAD TEST CAPABILITIES FOR TROUBLESHOOTING THEIR COMPUTER. THE SYSTEMS ACTUALLY INSTALLED WERE A DIFFERENT COMPUTER OF WHICH WE DID NOT HAVE THE MICROPROCESSOR TEST PODS FOR TESTING. NOW ANOTHER COMPUTER IS BEING USED. THIS PRESENTS PROBLEMS IN MAINTENANCE AND THE REQUIREMENT OF STOCKING MORE AND MORE SPARES. IN A COST EFFECTIVE MAINTENANCE PROGRAM THERE IS A NEED FOR STANDARDIZATION OF EQUIPMENT.

RECOMMENDATIONS

REQUIRE MODEM COMMUNICATION TO THE SIGN TO BE CHANGEABLE, SO THE BAUD RATE CAN BE LOWERED WHEN THERE IS POOR COMMUNICATIONS. THE WEIGH IN MOTION PROGRAM USES THIS METHOD AND IS NECESSARY IN THE MORE REMOTE LOCATIONS WHERE THE LINES OCCASIONALLY BECOME TOO NOISY.

HAVE A REMOTE POWER DOWN MODEM IN THE SIGN LOCATION SO THE SYSTEM CAN BE RESET REMOTELY.

VENDOR RECOMMENDATIONS

INCLOSED ARE SOME RECOMMENDATIONS FROM THE VENDOR.

APPENDIX D

FIBEROPTIC DISPLAY SYSTEMS

FIBEROPTIC DISPLAY SYSTEMS, INC. - 90 DOUGLAS PIKE - SMITHFIELD RI 02917
TEL (401) 232-3370 / FAX : (401) 232-7130

January 19, 1994

Mr. Arlo Bones
Oregon Department of Transportation
3700 S.E. 92nd Street
Portland, OR 97266

Subject: Upgrade to existing SYLVIA® signs

Dear Arlo,

Further to our conversation on January 13, 1994, I've provided a description of various upgrades we have done to our equipment. Also included, is a description of work that should be performed the next time the signs require service.

SUGGESTIONS:

I would like to pose the following maintenance recommendations.

1. At the next maintenance checkup, wash the inside and outside of all the front faces. After doing this, the sign will have a slightly brighter and more consistent display. This should be done once a year.

2. Clean the 2-way beam splitter mirrors.

3. Inspect the flashing beacons.

In the three years since we built your signs, we have made several design modifications. I would like to suggest these to you to upgrade your present signs.

1. Close the "old" two-way ventilation louvers in the back of the sign and install the "new" one-way vets. The new vents reduce the amount of airborne contaminants entering the sign. This increases the life of the electrical connections, reducing the buildup of dust and automobile exhaust inside the sign and on the 2-way mirrors.

2. Due to a change by the manufacturer of the lamps, we have converted from a two-piece lamp/reflector to a one-piece lamp/reflector. The new design provides for greater lamp intensity, by changing and more precisely focusing the light from the lamps on the common end of the Fiberoptic harness. There is also a 300% increase in rated life of the bulb. It will also reduce the time required to change the lamps by simplifying the process.

Cost breakdowns are:

Lamp conversion - kit only: $8.00 (this does not include any lamps)

Lamp #64004 - one piece unit with reflector: $11.85 (This is a 2,000 hour lamp.)

Lamp #64005 - one piece unit with reflector: $22.00 (This is a 6,000 hour lamp.)

Lamp conversion kit with two #64004 lamps: $28.50

Lamp conversion kit with two #64005 lamps: $50.25

The cost of the conversion kit is well worth it, when you consider the time reduction for lamp and reflector changes, and the increased life and performance of the new lamp.

3. We have converted to a mechanical locking mechanism that could be installed in place of the gas struts. Presently, there are two struts per door. Only one mechanized latch would need to be installed for every two struts. The new latches would also allow the door to open up to ≈ 135°, allowing more room and easier access to the internal parts of the sign. I'm not sure if your gas struts are discharging, you will need to inspect them.

4. Your sign is equipped with front face heating. These heaters consume ≈ 800 watts of power year-round. The heaters are only required in the winter to prevent the accumulation of ice and snow on the front face. A thermostat could be installed inside the sign, to activate the heaters, when the internal sign temperature gets below 40°F. The cost of this thermostat would pay for itself in less than one year, and extend the life of the heat strips by 300%.

If you are interested in any of these suggestions, please contact me. We will be glad to provide you with more information, as well as the cost and time required to make these changes. All of these changes could be done by your people, or if you would prefer, by FDS.

Sincerely,

Ken Benevides

Kenneth A. Benevides
Field Services Manager
Fiberoptic Display Systems, Inc.

KAB/ch
ref: 9401/L5192/JC1019

cc: AJC, PD