7.

Ramp/Weave Analysis

- o 2012 Existing
- o 2035 No Build
- o 2035 Build Alternatives

- Tit					
		-			

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Mer	ae	Ana	lν	si	s
			z		_

Analyst: NBS (Ex7_SB-On AM)

Agency/Co.: VHB

Date performed: 7/3/2012

Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Conditions

Description: FEET I-293

F	r	е	е	W	a	Ţ	D	a	t	a	

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1830	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	655	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)_____

No

vph

Does adjacent ramp exist?

Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent
,			Ramp
Volume, V (vph)	1830	655	vph
Peak-hour factor, PHF	0.89	0.85	
Peak 15-min volume, v15	514	193	v
Trucks and buses	4	2	용
Recreational vehicles	0	0	왕
Terrain type:	Level	Level	
Grade	왕	왕	%
Length	mi	m:	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Driver population factor, fP 2097 778 pcph Flow rate, vp Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L =ΕQ Using Equation Ρ 1.000 FM2097 pc/h (P) =F FM12 Capacity Checks Maximum LOS F? Actual 2875 4600 No v FO4600 No 2875 R12 Level of Service Determination (if not F)____ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L23.8 pc/mi/ln 12 Level of service for ramp-freeway junction areas of influence C Speed Estimation_ Intermediate speed variable, = 0.348M S Space mean speed in ramp influence area, S = 53.7mph R Space mean speed in outer lanes, S = N/Amph

0.

S = 53.7

mph

0.980

1.00

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

0.990

1.00

Merge Analysis

VHB, Inc

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Analyst:	NBS	(Ex6	SB-On .	AM)	

Agency/Co.: VHB

Date performed: 7/3/2012

Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / SB

Junction: Exit 6 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Conditions

Description: FEET I-293

Freeway Dat

Type of analysis	Merge
Number of lanes in freeway	2
Free-flow speed on freeway	60.0 mph
Volume on freeway	2550 vph

On Ramp Data

Side of freeway	Right	•
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	655	vph
Position of adjacent Ramp	Upstream	_
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1500	ft

__Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent	3
	•		Ramp	
Volume, V (vph)	2550	385	655	vph
Peak-hour factor, PHF	0.89	0.93	0.80	
Peak 15-min volume, v15	716	103	205	v
Trucks and buses	4	2	0	용
Recreational vehicles	0	0	0	용
Terrain type:	Level	Level	Level	
Grade	왕	%		왕
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjus Driver population f		0.980 1.00	0.990 1.00	1.000 1.00	
Flow rate, vp		2922	418	819	pcph
	Estimation	of V12 Merge	Areas		
· T	=	(Equation 2	5-2 or 25-3)		
	= EQ	(Equation 2	5-2 Of 25-3)		
-	= 1.000 FM	Using Equat	ion 0		
	= V (P) = 2 12 F FM	2922 pc/h			
	Capac	city Checks			
	_	_			
77	Actual 3340	Maximum 4600	LOS	F?	
V FO	3340	4000	110		
v R12	3340	4600	No		
			// =>		
	vel of Service De	etermination	(II not F)		
Density, $D = 5.475$				29.5	pc/mi/ln
R Level of service fo	R r ramp-freeway ii		A of influence	e D	
Hever or pervice to	r ramp rreeway je				
	Speed B	Estimation			
Intermediate speed	variable,	M S	= 0.410		•
Space mean speed in	ramp influence a	area, S R	= 52.6 mpl	1	
Space mean speed in	outer lanes,	S 0	= N/A mpl	n	
Space mean speed fo	r all vehicles,	S	= 52.6 mpl	n	

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	i	V	е	r	g	е	An	a	1	У	'S	i	S

Analyst:

NBS (Ex6 NB-Off AM)

Agency/Co.:

VHB

Date performed:

7/3/2012

Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2012 Existing Condition

Description: FEET I-293

F	r	е	е	W	a	У	D	а	t	а
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Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0.	mph
Volume on freeway	1825	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	955	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)_____

No

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

Distance to adjacent ramp

vph

ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp
Volume, V (vph)	1825		955		vph
Peak-hour factor, PHF	0.91		0.85		*
Peak 15-min volume, v15	501		281		v
Trucks and buses	5		1		90
Recreational vehicles	0		0		0,0
Terrain type:	Level		Level		
Grade	0.00	응	0.00	양	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	1.5		1.5		
Recreational vehicle PCE, ER	1.2		1.2		

Driver population factor, fP 1.00 1.00 1129 2056 pcph Flow rate, vp Estimation of V12 Diverge Areas_ (Equation 25-8 or 25-9) L ΕQ Using Equation 0 Ρ 1.000 FD+ (v - v) P = 2056F R FD12 ____Capacity Checks__ LOS F? Actual Maximum 4600 No 2056 v F Fi 4400 No 2056 12 927 4600 No FΟ F R 2100 1129 No v R Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 Lpc/mi/ln Density, 19.5 12 Level of service for ramp-freeway junction areas of influence B Speed Estimation_ Intermediate speed variable, D = 0.400S Space mean speed in ramp influence area, S = 52.8mph R Space mean speed in outer lanes, S = N/Amph 0

S = 52.8

mph

0.976

0.995

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

	***************************************	Merge	Analysis_		
Analyst:	NBS	(Ex6_NB-On	_AM)		
7000000/00	TTTTT				

Agency/Co.: VHB Date performed: 7/3/2012 Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / NB Junction: Exit 6 NB On Ramp

Jurisdiction: NHDOT

2012 Evigting Conditi Analysis Vear

Analysis Year: 2012 Exist Description: FEET I-293	ing Conditions
	Freeway Data
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 2 60.0 mph 870 vph
	On Ramp Data
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Right 1 40.0 mph 610 vph 250 ft ft
Adjacent H	Ramp Data (if one exists)
Does adjacent ramp exist? Volume on adjacent Ramp	No vph

Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp

Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjace Ramp	ent
Volume, V (vph)	870	610		vph
Peak-hour factor, PHF	0.91	0.92		1,5
Peak 15-min volume, v15	239	166		v
Trucks and buses	5	2		%
Recreational vehicles	0	0		٠ ا
Terrain type:	Level	Level		
Grade	양		ે	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

ft

Driver population factor, fP 1.00 pcph 980 670 Flow rate, vp Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L = ΕQ Р Using Equation 0 1.000 FM(P) =980 pc/h FM12 ___Capacity Checks___ LOS F? Actual Maximum 4600 No 1650 v FO 4600 No 1650 R12 Level of Service Determination (if not F)____ pc/mi/ln Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L16.5 12 Level of service for ramp-freeway junction areas of influence B ____Speed Estimation_ Intermediate speed variable, = 0.321M S Space mean speed in ramp influence area, S = 54.2mph R S = N/Amph Space mean speed in outer lanes, 0

S

= 54.2

mph

0.976

0.990

1.00

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysis

Analyst: NBS (Ex7_NB-Off_AM)

Agency/Co.: VHB

Date performed: 7/3/2012

Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Condition

Description: FEET I-293

F	'n	ee,	wa	У	Dat	ca	

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1480	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	545	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane	· ·	ft

_____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp

Distance to adjacent ramp

vph

ft

Conversion to pc/h Under Base Conditions

No

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	1480	545	vph
Peak-hour factor, PHF	0.91	0.68	-
Peak 15-min volume, v15	407	200	v
Trucks and buses	5	2	%
Recreational vehicles	0	0	&
Terrain type:	Level	Level	
Grade	0.00 %	0.00 용	웅 .
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Driver population factor, fP 1.00 1.00 1667 809 pcph Flow rate, vp Estimation of V12 Diverge Areas (Equation 25-8 or 25-9) L = ΕQ Using Equation 0 P 1.000 FD+ (v - v) P = 1667F R FD _____Capacity Checks_ Maximum LOS F? Actual 1667 4600 NoFi F 4400 No 1667 12 858 4600 No F R FΟ 809 2100 No v R Level of Service Determination (if not F)_ pc/mi/ln D = 4.252 + 0.0086 v - 0.009 L15.7 Density, 12 Level of service for ramp-freeway junction areas of influence B Speed Estimation D = 0.371Intermediate speed variable, S Space mean speed in ramp influence area, S = 53.3mph R Space mean speed in outer lanes, S = N/Amph 0

S = 53.3

mph

0.976

0.990

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Merae	Ana	LV	Sis

Analyst: NBS (Ex7_SB-On_PM)

Agency/Co.: VHB Date performed: 7/3/2012 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: Analysis Year: NHDOT

2012 Existing Conditions

Description: FEET I-293

F	r	e	e	w	а	v	D	a	t	a

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1585	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	390	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)

No

Does adjacent ramp exist?

Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp

Distance to adjacent Ramp

ft

vph

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacer Ramp	nt
Volume, V (vph)	1585	390		vph
Peak-hour factor, PHF	0.92	0.86		_
Peak 15-min volume, v15	431	113		v
Trucks and buses	5	2		8
Recreational vehicles	0	0		8
Terrain type:	Level	Level		
Grade	용		ે	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Driver population factor, fP 1766 458 pcph Flow rate, vp Estimation of V12 Merge Areas_ (Equation 25-2 or 25-3) L = ΕQ P = 1.000 Using Equation 0 FM(P) = 1766pc/h FM12 F ___Capacity Checks___ LOS F? Actual Maximum 4600 No 2224 v FO 4600 No 2224 R12 Level of Service Determination (if not F) pc/mi/ln Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =18.8 12 Level of service for ramp-freeway junction areas of influence B ____Speed Estimation__ Intermediate speed variable, M = 0.315S Space mean speed in ramp influence area, S = 54.3mph R Space mean speed in outer lanes, S = N/Amph 0

S

= 54.3

mph

0.976

1.00

0.990

1.00

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Analysis
•	

Analyst: NBS (Ex6_SB-On_PM)

Agency/Co.: VHB
Date performed: 7/3/2012
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 6 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Conditions

Description: FEET I-293

F	re	ew	ay	Da	ta
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Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2075	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	335	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent Ramp

Position of adjacent Ramp

Type of adjacent Ramp

Distance to adjacent Ramp

1500

Test

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacen	it
			Ramp	
Volume, V (vph)	2075	335	405	vph
Peak-hour factor, PHF	0.92	0.96	0.87	
Peak 15-min volume, v15	564	87	116	v
Trucks and buses	5	1	1	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%		%	양
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.976 1.00 2312	0.995 1.00 351	0.995 1.00 468	pcph
E	stimation of	V12 Merge A	reas		
L = EQ	. (E	quation 25-	2 or 25-3)		
	1.000 Us	sing Equatic	on 0		
	(P) = 2312 FM	pc/h			
	Capacity	Checks	:		
v	Actual 2663	Maximum 4600	LOS No	F?	
FO v R12	2663	4600	No		, · · · · ·
Level of	Service Deter	rmination (i	f not F)		
Density, D = 5.475 + 0.007 R Level of service for ramp-	R	12	A		pc/mi/ln
	Speed Esti	.mation	·		
Intermediate speed variabl		***************************************	0.356		
Space mean speed in ramp i	nfluence area		53.6 mpl	n ·	
Space mean speed in outer	lanes,	S = 0	N/A mpl	ı	rati Siling a siling silin
Space mean speed for all v	ehicles,	S =	53.6 mpl	n ·	. "

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS (Ex6_NB-Off_PM)

Agency/Co.: VHB Date performed: 7/3/2012 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT
Analysis Year: 2012 Existing Condition

Description: FEET I-293

rreeway Data	Freeway Data
--------------	--------------

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3310	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	1070	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist? Volume on adjacent ramp

Position of adjacent ramp Type of adjacent ramp

Distance to adjacent ramp

vph

ft

Conversion to pc/h Under Base Conditions

No

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3310	1070	vph
Peak-hour factor, PHF	0.91	0.94	_
Peak 15-min volume, v15	909	285	v
Trucks and buses	5	1	%
Recreational vehicles	0	0	90
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Driver population factor, fP 1.00 1.00 3728 1144 pcph Flow rate, vp Estimation of V12 Diverge Areas_ (Equation 25-8 or 25-9) L = ΕQ P 1.000 Using Equation 0 FD+ (v - v)' P = 3728 pc/hF R FD12 ____Capacity Checks_ LOS F? Actual Maximum 3728 4600 No Fi No 4400 3728 12 2584 4600 No FΟ F R 1144 2100 No v R Level of Service Determination (if not F)__ D = 4.252 + 0.0086 v - 0.009 L =33.8 pc/mi/ln Density, 12 Level of service for ramp-freeway junction areas of influence D Speed Estimation_ Intermediate speed variable, D = 0.401S Space mean speed in ramp influence area, S = 52.8mph \mathbf{R} Space mean speed in outer lanes, S = N/Amph 0

S = 52.8

mph

0.976

0.995

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

____Merge Analysis_____

Analyst: NBS (Ex6_NB-On_PM)

Agency/Co.: VHB Date performed: 7/3/2012 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Conditions

Description: FEET I-293

	Freeway Data		
	•		
Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	60.0	mph	
Volume on freeway	2240	vph	

On	Ramp	D	a	t	а
					-

No

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	40.0	mph
Volume on ramp	910	vph
Length of first accel/decel lane	250	ft
Length of second accel/decel lane		ft

__Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp

vph

Type of adjacent Ramp Distance to adjacent Ramp ft

Conver	sion to	pc/h	Under	Base	Conditions	
--------	---------	------	-------	------	------------	--

Junction Components	Freeway	Ramp	Adjacen	t
	,		Ramp	
Volume, V (vph)	2240	910		vph
Peak-hour factor, PHF	0.91	0.94		
Peak 15-min volume, v15	615	242		v
Trucks and buses	5	1		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%		%	양
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Driver population factor, fP 1.00 1.00 2523 973 pcph Flow rate, vp Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L = ΕQ P = Using Equation 0 1.000 FM2523 pc/h (P) =12 FM___Capacity Checks_ Actual Maximum LOS F? 3496 4600 No FO 4600 No 3496 R12 Level of Service Determination (if not F)____ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L30.7 pc/mi/ln 12 Level of service for ramp-freeway junction areas of influence D Speed Estimation_ Intermediate speed variable, M = 0.430S Space mean speed in ramp influence area, S = 52.3mph R Space mean speed in outer lanes, S = N/Amph 0

S = 52.3

mph

0.976

0.995

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

_Diverge	Analysis	_

Analyst: NBS (Ex7_NB-Off_PM)

Agency/Co.: VHB

Date performed: 7/3/2012

Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2012 Existing Condition

Description: FEET I-293

 	 	 	 rree	way .	Dala _.
 _					

Type of analysis Diverge
Number of lanes in freeway 2
Free-flow speed on freeway 60.0 mph
Volume on freeway 3150 vph

____Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	950	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		£t

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?
Volume on adjacent ramp
Position of adjacent ramp
Type of adjacent ramp
Distance to adjacent ramp

vph

ft

Conversion to pc/h Under Base Conditions

No

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3150	950	vph
Peak-hour factor, PHF	0.91	0.91	-
Peak 15-min volume, v15	865	261	V
Trucks and buses	5	0	96
Recreational vehicles	0	0	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

3548 1044 pcph Flow rate, vp Estimation of V12 Diverge Areas_ (Equation 25-8 or 25-9) L =ΕQ Using Equation 0 Р 1.000 FD+ (v - v) P = 3548F R FD12 _Capacity Checks_ LOS F? Actual Maximum 3548 4600 No v Fi F No 4400 3548 12 2504 4600 No FO F R 1044 2100 No v R Level of Service Determination (if not F)_ D = 4.252 + 0.0086 v - 0.009 Lpc/mi/ln Density, 12 Level of service for ramp-freeway junction areas of influence D Speed Estimation_ Intermediate speed variable, D = 0.392S S = 52.9mph Space mean speed in ramp influence area, R mph Space mean speed in outer lanes, S = N/A

0

S = 52.9

mph

0.976

1.00

Heavy vehicle adjustment, fHV Driver population factor, fP

Space mean speed for all vehicles,

1.000

1.00

HCS2000: Freeway Weaving Release 4.1f

VHB, Inc

VHB

101 Walnut St. Watertown MA

Jurisdiction:

Phone: 617-924-1770

E-mail:

Fax:

__Operational Analysis_____

Analyst: NBS (Ex6 SB AM)

Agency/Co.: VHB
Date Performed: 7/3/2012
Analysis Time Period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB
Weaving Location: Exit 6

Analysis Year: 2012 Existing Condition

NHDOT

Description: FEET I-293

_Inputs Freeway free-flow speed, SFF 60 mph Weaving number of lanes, N 3 Weaving segment length, L 500 ft Terrain type Level Grade 왕 Length mi Weaving type Volume ratio, VR 0.43 Weaving ratio, R 0.49

_Conversion to pc/h Under Base Conditions_____

	Non-Weaving		Weaving		
	V	V	V	V	
	A-C	B-D	A-D	B-C	
Volume, V	1835	5	650	715	veh/h
Peak-hour factor, PHF	0.89	0.93	0.80	0.93	
Peak 15-min volume, v15	515	2	203	192	v
Trucks and buses	4	.1	0	1	왕
Recreational vehicles	0	0	0	0	양
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.980	0.995	1.000	0.995	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2103	5	812	772	pc/h

_Weaving and Non-Weaving Speeds_____

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.27	1.44
Weaving and non-weaving speeds, Si	30.30	35.52
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 1.32
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity___

Weaving segment speed, S Weaving segment density, D		mph pc/mi/ln
Level of service, LOS	E	<u>-</u>
Capacity of base condition, cb	4099	pc/h
Capacity as a 15-minute flow rate, c	4019	pc/h
Capacity as a full-hour volume, ch	3540	pc/h

Limitations on Weaving Segments

		If Max Exceeded See			
	Analyzed	Maximum	Note		
Weaving flow rate, Vw	1584	2800	a		
Average flow rate (pcphpl)	1230	2300	b		
Volume ratio, VR	0.43	0.45	C		
Weaving ratio, R	0.49	N/A	đ		
Weaving length (ft)	500	2500	е		
Motoro					

Notes:

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000: Freeway Weaving Release 4.1f

VHB, Inc VHB 101 Walnut

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

_____Operational Analysis_____

Analyst: NBS (Ex6 SB PM)

Agency/Co.:

Date Performed:

Analysis Time Period:

Freeway/Dir of Travel:

Weaving Location:

Jurisdiction:

VHB

7/3/2012

PM Peak Hour

Free Exit 6

NHDOT

Analysis Year: 2012 Existing Condition

Description: FEET I-293

Inputs_____

Freeway free-flow speed, SFF	60 mph
Weaving number of lanes, N	3
Weaving segment length, L	500 ft
Terrain type	Level
Grade	90
Length	mi
Weaving type	A
Volume ratio, VR	0.38
Weaving ratio, R	0.43

__Conversion to pc/h Under Base Conditions_____

	Non-Weaving		Weaving		
	V	V	V	V	
·	A-C	B-D	A-D	B-C	
Volume, V	1570	5	400	500	veh/h
Peak-hour factor, PHF	0.92	0.80	0.87	0.80	•
Peak 15-min volume, v15	427	2	115	156	v
Trucks and buses	5	0	1	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.976	1.000	0.995	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1749	6	462	624	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.63	0.89
Weaving and non-weaving speeds, Si	33.98	41.40
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 1.17
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity_

Weaving segment speed, S Weaving segment density, D	38.21 24.78	mph pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	4235	pc/h
Capacity as a 15-minute flow rate, c	4132	pc/h
Capacity as a full-hour volume, ch	3667	pc/h

Limitations on Weaving Segments

		eded See Note		
	Analyzed	Maximum	Note	
Weaving flow rate, Vw	1086	2800	a	
Average flow rate (pcphpl)	947	2300	b	
Volume ratio, VR	0.38	0.45	С	
Weaving ratio, R	0.43	N/A	đ	
Weaving length (ft)	500	2500	е	
Notes:	•			

- Notes:
- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

_____Merge Analysis____

Analyst:

NBS (Ex7_SB-On_AM)

Agency/Co.:

VHB

Date performed: Analysis time period: AM Peak Hour

7/31/2012 Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB On Ramp

Jurisdiction:

NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

Distance to adjacent Ramp

	Freeway D	2+2	
	_rreeway D	aca	
Type of analysis		Merge	
Number of lanes in freeway		2	
Free-flow speed on freeway		60.0	mph
Volume on freeway		2300	vph
	_On Ramp D	ata	
Side of freeway		Right	
Number of lanes in ramp		1	
Free-flow speed on ramp		35.0	mph
Volume on ramp		825	vph
Length of first accel/decel lane		600	ft
Length of second accel/decel lane			ft
Adjacent	Ramp Data	(if one exists)
Does adjacent ramp exist?		No	•
Volume on adjacent Ramp			vph
Position of adjacent Ramp			-
Type of adjacent Ramp			

_Conversion to pc/h Under Base Conditions____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2300	825	-	vph
Peak-hour factor, PHF	0.90	0.90		4.
Peak 15-min volume, v15	639	229		v
Trucks and buses	4	2		용
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	왕	용	:	हें ह
Length	mi	m	i	ni
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

ft

1.00 Driver population factor, fP 1.00 Flow rate, vp 2607 926 pcph Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L = ΕQ Using Equation 0 Р 1.000 FM2607 (P) =pc/h FM12 Capacity Checks_ LOS F? Actual Maximum 3533 4600 No v FO 3533 4600 No R12 _Level of Service Determination (if not F)____ pc/mi/ln Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L28.8 Level of service for ramp-freeway junction areas of influence D __Speed Estimation_ Intermediate speed variable, M = 0.412S Space mean speed in ramp influence area, S = 52.6mph R Space mean speed in outer lanes, S = N/Amph 0

S = 52.6

mph

0.980

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

0.990

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge Analysis

Analyst: NBS (Ex6 SB-On AM)

Agency/Co.: VHB

Date performed: 7/31/2012
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 6 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

Freeway Data	Fi	cee	ew.	av	D	a ·	t	a
--------------	----	-----	-----	----	---	-----	---	---

Type of analysis	Merge	•
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3205	vph

On Ramp Data

Side of freeway	Right	•
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

vph

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 825

Position of adjacent Ramp Upstream
Type of adjacent Ramp Off

Type of adjacent Ramp Off
Distance to adjacent Ramp 1500 ft

_____Conversion to pc/h Under Base Conditions

Junction Components		Freeway		Ramp		Adjacer	nt
•						Ramp	
Volume, V (vph)		3205		485		825	vph
Peak-hour factor, PHF		0.90		0.90		0.90	
Peak 15-min volume, v15		890		135		229	V
Trucks and buses		4		2		0	용
Recreational vehicles		0		0		0	용
Terrain type:		Level		Level		Level	
Grade		!	응		용		양
Length		τ	mi		mi		mi
Trucks and buses PCE, ET		1.5		1.5		1.5	
Recreational vehicle PCE,	ER	1.2		1.2		1.2	

Heavy vehicle adju	stment, fHV	0.980) 0	.990	1.000	
Driver population	factor, fP	1.00		.00	1.00	
Flow rate, vp		3632	5	44	917	pcph
	Estimati	on of V12 M	Merge Are	as	,	
	L = EQ	(Equati	on 25-2	or 25-3)		
	P = 1.000 FM	Using E	Equation	0		
		: 3632 pc	c/h			
	Ca	pacity Chec	cks			
	7 cetter o 7	N/ O τ	cimum	LOS F	7.5	
V	Actual 4176	. Max 460		No	•	
FO	1170			2.0		•
v	4176	460	0	No		
R12						
L	evel of Service	e Determinat	cion (if	not F)		
Density, D = 5.475		0.0078 v		27 L =	35.9	pc/mi/ln
Level of service f			areas of	influence	E	
	Snee	d Estimatio	າກ			
	ppee	d Escimació	711			· .
Intermediate speed	variable,		M = 0.	554		
Space mean speed i	n ramp influenc	e area,	S = 50 R	.0 mph		
Space mean speed i	n outer lanes,		S = N	/A mph		
Space mean speed f	or all vehicles	3 ₇ ·	S = 50	.0 mph		. **

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

____Diverge Analysis______

Analyst:

NBS (Ex6 NB-Off AM)

Agency/Co.:

VHB

Date performed:

7/31/2012

Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

Freeway Data_____

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2295	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	275	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

No

Does adjacent ramp exist?

Volume on adjacent ramp Position of adjacent ramp

vph

Type of adjacent ramp

Distance to adjacent ramp

ft

_Conversion	to	pc/h	Under	Base	Conditions

Junction Components	Freeway	Ramp	Adjacent
			Ramp
Volume, V (vph)	2295	1200	vph
Peak-hour factor, PHF	0.90	0.90	·
Peak 15-min volume, v15	637	333	v
Trucks and buses	5	1	왕
Recreational vehicles	0	0	%
Terrain type:	Level	Level	
Grade	0.00 %	0.00 % .	왕
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Driver population factor, fP 1.00 1.00 2614 1340 Flow rate, vp pcph Estimation of V12 Diverge Areas (Equation 25-8 or 25-9) L = ΕQ P = 1.000 Using Equation 0 FD+ (v - v) P = 2614F R R FD12 ____Capacity Checks_ Actual Maximum LOS F? 2614 4600 No Fi F 4400 No 2614 12 1274 4600 No FΟ F R 1340 2100 No v R Level of Service Determination (if not F)___ D = 4.252 + 0.0086 v - 0.009 L24.3 pc/mi/ln Density, 12 Level of service for ramp-freeway junction areas of influence C Speed Estimation Intermediate speed variable, D = 0.419S Space mean speed in ramp influence area, mph S = 52.5R Space mean speed in outer lanes, S = N/Amph

0

S = 52.5

mph

0.976

0.995

Heavy vehicle adjustment, fHV

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge Analysis	

Analyst:

NBS (Ex6 NB-On AM)

Agency/Co.:

VHB

Date performed:

7/31/2012 Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / NB Junction:

Exit 6 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 No Build

Description: FEET I-293

Description: PEEL 1-293	•				
	Freeway Da	ıta			
Type of analysis Number of lanes in freeway		Merge 2			
Free-flow speed on freeway Volume on freeway		60.0 1095		mph vph	
	On Ramp Da	ıta			
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane		Right 1 40.0 765 250		mph vph ft ft	
Adjacent H	Ramp Data	(if one e	exists)		
Does adjacent ramp exist? Volume on adjacent Ramp		No		vnh	

Volume on adjacent Ramp

vph

Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp

ft

Conversion to pc/h Under Base Conditions____

Junction Components	Freeway	Ramp		Adjacen Ramp	t
Volume, V (vph)	1095	765			vph
Peak-hour factor, PHF	0.90	0.90			1
Peak 15-min volume, v15	304	212			v
Trucks and buses	5	2			왕
Recreational vehicles	0	0			ે
Terrain type:	Level	Level			
Grade	양		%		왕
Length	mi		mi		mi
Trucks and buses PCE, ET	1.5	1.5			
Recreational vehicle PCE, ER	1.2	1.2			

Driver population factor, fP 1247 858 pcph Flow rate, vp Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L = ΕQ Using Equation 0 Ρ 1.000 FM1247 pc/h (P) =12 FM___Capacity Checks_ Actual Maximum LOS F? 2105 4600 No v. FO 4600 No 2105 R12 Level of Service Determination (if not F)__ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L19.9 pc/mi/ln 12 Level of service for ramp-freeway junction areas of influence B ___Speed Estimation_ Intermediate speed variable, M = 0.333S Space mean speed in ramp influence area, S = 54.0mph R Space mean speed in outer lanes, S = N/Amph 0

S

= 54.0

mph

0.976

1.00

0.990

1.00

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysi	. 8
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Analyst: NBS (Ex7 NB-Off AM)

Agency/Co.: VHB

7/31/2012 Date performed: Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Exit 7 NB Off Ramp Junction:

Jurisdiction: NHDOT

Analysis Year: NHDOT 2035 No Build

Description: FEET I-293

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1860	vph

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	685	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane	•	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?

Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp

Distance to adjacent ramp

vph

£t.

Conversion to pc/h Under Base Conditions_____

No

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	1860	685	vph
Peak-hour factor, PHF	0.90	0.90	
Peak 15-min volume, v15	517	190	v
Trucks and buses	5	2	%
Recreational vehicles	0	0	용
Terrain type:	Level	Level	
Grade	0.00 %	0.00 %	왕
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

Driver population factor, fP 2118 769 pcph Flow rate, vp Estimation of V12 Diverge Areas (Equation 25-8 or 25-9) L = ΕQ Р 1.000 Using Equation 0 FD + (v - v) P = 211812 \mathbf{F} R _Capacity Checks_ LOS F? Actual Maximum 2118 4600 No Fi F 4400 No 2118 12 4600 No 1349 FΟ F R 769 2100 No v R Level of Service Determination (if not F)_ pc/mi/ln D = 4.252 + 0.0086 v - 0.009 L19.5 Density, 12 Level of service for ramp-freeway junction areas of influence B Speed Estimation Intermediate speed variable, D = 0.367S Space mean speed in ramp influence area, S = 53.4mph R Space mean speed in outer lanes, S = N/Amph

0.976

1.00

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

0.990

1.00

= 53.4

mph

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS (Ex7_SB-On PM)

Agency/Co.: VHB
Date performed: 7/31/2012
Analysis time period: PM Peak Ho

Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / SB Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

F.	re	ew	av	Da	ta
J	エレ	C **	uν	υu	-u

Type of analysis	٠	Merge	
Number of lanes in freeway		2	
Free-flow speed on freeway		60.0	mph
Volume on freeway		1995	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	490	vph
Length of first accel/decel lane	600	ft
Length of second accel/decel lane		ft

____Adjaçent Ramp Data (if one exists)_____

No

vph

Does adjacent ramp exist?

Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp

Distance to adjacent Ramp ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1995	490		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	554	136		v
Trucks and buses	5	2		%
Recreational vehicles	0	0		앙
Terrain type:	Level	Level		
Grade	왕		ે	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Driver population factor, fP 1.00 1.00 2272 550 pcph Flow rate, vp Estimation of V12 Merge Areas (Equation 25-2 or 25-3) L = ΕQ Ρ Using Equation 0 1.000 FM(P) = 2272pc/h 12 FM___Capacity Checks_ LOS F? Actual Maximum 2822 4600 No FO 4600 No 2822 R12 _Level of Service Determination (if not F)____ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L23.5 pc/mi/ln Level of service for ramp-freeway junction areas of influence C ____Speed Estimation_ Intermediate speed variable, M = 0.345S Space mean speed in ramp influence area, S = 53.8mph R Space mean speed in outer lanes, S = N/Amph 0

S = 53.8

mph

0.976

0.990

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

***************************************	Merge Analysis	
Analyst.	NRS (Ex6 SR-On DM)	

Analyst: NBS (Ex6_SB-On_PM)

Agency/Co.: VHB

Date performed: 7/31/2012
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 6 SB On Ramp Jurisdiction: NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

	Freeway	Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2610	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

__Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent Ramp

Position of adjacent Ramp

Type of adjacent Ramp

Off

Yes

Vph

Upstream

Off

Type of adjacent Ramp Off
Distance to adjacent Ramp 1500 ft

Junction Components	Freeway	Ramp	Adjacent	
			Ramp	
Volume, V (vph)	2610	420	510	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	725	117	142	v
Trucks and buses	5	1	1	ક
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	양	양		%
Length	mi	mi	1	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju Driver population Flow rate, vp		0.976 1.00 2972	0.995 1.00 469	0.995 1.00 570	pcph
***************************************	Estimation o	of V12 Merge	Areas		
	L = EQ	(Equation 2	5-2 or 25-3) .	
		Using Equat	ion 0		
	v = v (P) = 29 12 F FM	972 pc/h			
AND DESCRIPTION OF THE PERSON	Capaci	ty Checks			
V	Actual 3441	Maximum 4600	LO	S F?	
FO		4600	No		
R12	3441	4600	NO		
	Level of Service Det	ermination	(if not F)_		
Density, D = 5.47	5 + 0.00734 v + 0.0	0078 v - 0 12	.00627 L	= 30.2	pc/mi/ln
Level of service	for ramp-freeway jur	nction areas	of influen	ce D	
	Speed Es	stimation			
Intermediate speed	d variable,	M	= 0.422		•
Space mean speed	in ramp influence ar	cea, S R	= 52.4 mj	oh	
Space mean speed :	in outer lanes,	S 0	= N/A m	oh	
Space mean speed :	for all vehicles,	S	= 52.4 m	ph	

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101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Anal	.vs	ĺS
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Analyst:

NBS (Ex6_NB-Off_PM)

Agency/Co.:

VHB

Date performed:

7/31/2012 Analysis time period: PM Peak Hour

Junction:

Freeway/Dir of Travel: I-293 / NB Exit 6 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 No Build

Description: FEET I-293

Freev	vay Data		
Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	60.0	mph	
Volume on freeway	4160	vph	
Off Ra	amp Data		
Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	45.0	mph	
Volume on ramp	1345	vph	
Length of first accel/decel lane	275	ft	
Length of second accel/decel lane		ft	
Adjacent Ramp	Data (if one ex	xists)	
Does adjacent ramp exist?	No		
Volume on adjacent ramp		vph	
Position of adjacent ramp		E	

Type of adjacent ramp

Distance to adjacent ramp

ft

•			
Freeway	Ramp		jacent mp
4160	1345		vph
0.90	0.90		-
1156	374		v
5	1		. %
0	0		%
Level	Level		
0.00 응	0.00	용	%
0.00 mi	0.00	mi	mi
1.5	1.5	•	
1.2	1.2		
	4160 0.90 1156 5 0 Level 0.00 % 0.00 mi	4160 1345 0.90 0.90 1156 374 5 1 0 0 Level Level 0.00 % 0.00 0.00 mi 0.00 1.5 1.5	Ra 4160 1345 0.90 0.90 1156 374 5 1 0 0 Level Level 0.00 % 0.00 % 0.00 mi 0.00 mi 1.5 1.5

Driver population factor, fP 1.00 1.00 4738 1502 pcph Flow rate, vp Estimation of V12 Diverge Areas (Equation 25-8 or 25-9) L ΕQ Using Equation 0 P 1.000 FD+ (v - v) P = 4738R F R FD12 ____Capacity Checks_ Maximum LOS F? Actual 4738 4600 Yes v = vF Fi 4400 Yes 4738 12 3236 4600 No FΟ \mathbf{F} R 1502 2100 No ν R Level of Service Determination (if not F)__ D = 4.252 + 0.0086 v - 0.009 L = 42.5pc/mi/ln Density, 12 Level of service for ramp-freeway junction areas of influence F Speed Estimation D = 0.433Intermediate speed variable, S Space mean speed in ramp influence area, S = 52.2mph R

S

0

= N/A

S = 52.2

mph

mph

0.976

0.995

Heavy vehicle adjustment, fHV

Space mean speed in outer lanes,

Space mean speed for all vehicles,

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge Analysis_____

Analyst:

NBS (Ex6 NB-On PM)

Agency/Co.:

VHB

Date performed: Analysis time period: PM Peak Hour

7/31/2012 Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293				
·	_Freeway Da	ata		· .
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway		Merge 2 60.0 2815	mph vph	
	_On Ramp Da	ata		
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane		Right 1 40.0 1145 250	mph vph ft ft	
Adjacent	Ramp Data	(if one exist	ts)	
Does adjacent ramp exist?		No		

Does adjacent ramp exist?

Volume on adjacent Ramp

vph

Position of adjacent Ramp Type of adjacent Ramp

Distance to adjacent Ramp

ft

Conv	rers:	ıon	to	pc/	h	Under	Base	Condit	cions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2815	1145	vph	
Peak-hour factor, PHF	0.90	0.90	.	
Peak 15-min volume, v15	782	318	v	
Trucks and buses	5	1	00	
Recreational vehicles	0	0	ે	
Terrain type:	Level	Level		
Grade	양	왕	00	
Length	mi	m	i mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Driver population factor, fP 1.00 1.00 3206 1279 pcph Flow rate, vp Estimation of V12 Merge Areas_ (Equation 25-2 or 25-3) L = ΕQ Using Equation 0 P = 1.000 FM(P) = 3206pc/h F FM12 ____Capacity Checks_ LOS F? Actual Maximum 4485 4600 No v FO No 4485 4600 R12 Level of Service Determination (if not F)____ Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L38.3 pc/mi/ln Level of service for ramp-freeway junction areas of influence E Speed Estimation_ Intermediate speed variable, M = 0.647S Space mean speed in ramp influence area, S = 48.4mph R Space mean speed in outer lanes, S = N/Amph 0

0.976

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

0.995

mph

S = 48.4

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	i	v	e	r	a	e	An	а	7	v	s	i	s	
			_	-1-	\supset	_	2 111	•	-	2	u	-1-		

Analyst: NBS (Ex7_NB-Off_PM)

Agency/Co.: VHB

Date performed: 7/31/2012
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7. NB Off Ramp

Jurisdiction:

NHDOT 2035 No Build

Analysis Year: 2035 No F

Description: FEET I-293

F	r	е	е	W	a	У	D	a	t	a	

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3960	vph

_Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	45.0	mph
Volume on ramp	1195	vph
Length of first accel/decel lane	325	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp

vph

ft

Conversion to pc/h Under Base Conditions_____

No

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3960	1195	vph
Peak-hour factor, PHF	0.90	0.90	-
Peak 15-min volume, v15	1100	332	v
Trucks and buses	5	0	%
Recreational vehicles	О .	0	&
Terrain type:	Level	Level	
Grade	0.00 %	0.00 용	%
Length	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	

1.00 Driver population factor, fP 1.00 1328 4510 pcph Flow rate, vp Estimation of V12 Diverge Areas (Equation 25-8 or 25-9) L ΕQ Р 1.000 .Using Equation 0 FD+ (v - v) P = 4510 \mathbf{F} R 12 R ___Capacity Checks_ LOS F? Actual Maximum 4600 No 4510 v = vFi F 4510 4400 Yes 12 4600 No 3182 FO F R 2100 No 1328 V \mathbb{R} Level of Service Determination (if not F)_ pc/mi/ln D = 4.252 + 0.0086 v - 0.009 L40.1 Density, 12 Level of service for ramp-freeway junction areas of influence F Speed Estimation Intermediate speed variable, D = 0.418S Space mean speed in ramp influence area, S = 52.5mph R Space mean speed in outer lanes, S = N/Amph 0

S

= 52.5

mph

0.976

1.000

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

HCS2000: Freeway Weaving Release 4.1f

VHB, Inc VHB 101 Walnu

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

O.	per	ati	onal	Analy	/sis
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Analyst: NBS (Ex6_SB_AM)

Agency/Co.: VHB

Date Performed: 7/31/2012
Analysis Time Period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB
Weaving Location: Exit 6
Jurisdiction: NHDOT

Analysis Year: 2035 No Build

Description: FEET I-293

____Inputs_____

Conversion to pc/h Under Base Conditions_____

	Non-Wea	ving	Weaving		
	V	V	V	V	
	A-C	B-D	A-D	B-C	
.Volume, V	2305	5	820	900	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	640	2	228	250	v
Trucks and buses	4	1	0	1	%
Recreational vehicles	0	0	0	0	용
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.980	0.995	1.000	0.995	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	•
Flow rate, v	2612	5	911	1004	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0:15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.74	1.84
Weaving and non-weaving speeds, Si	28.38	32.60
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 1.34
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity___

Weaving segment speed, S	30.67	
Weaving segment density, D	49.25	pc/mi/ln
Level of service, LOS	F	
Capacity of base condition, cb	4117	pc/h
Capacity as a 15-minute flow rate, c	4036	pc/h
Capacity as a full-hour volume, ch	3632	pc/h

Limitations on Weaving Segments

		If Max Exce	eded See Note
	Analyzed	Maximum	Note
Weaving flow rate, Vw	1915	2800	a
Average flow rate (pcphpl)	1510	2300	b
Volume ratio, VR	0.42	0.45	C .
Weaving ratio, R	0.48	N/A	đ
Weaving length (ft)	500	2500	е
37			

Notes:

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

HCS2000: Freeway Weaving Release 4.1f

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst:

VHB

Agency/Co.: Date Performed:

Analysis Time Period: PM Peak Hour

7/31/2012

NBS (Ex6 SB PM)

Freeway/Dir of Travel: I-293 / SB Weaving Location: Exit 6

Jurisdiction:

NHDOT

Analysis Year:

2035 No Build

Description: FEET I-293

Inputs

Process from flow ground GEE		
Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	. 3	
Weaving segment length, L	500	ft
Terrain type	Level	
Grade		9
Length		mi
Weaving type	A	
Volume ratio, VR	0.36	
Weaving ratio, R	0.45	

Conversion to pc/h Under Base Conditions_____

	Non-Weaving		Weaving		
	V	V	V	V	,
	A-C	B-D	A-D	B-C	
Volume, V	1980	5	505	630	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	550	2	140	175	v
Trucks and buses	5	0	1	0	%
Recreational vehicles	0	0	0	0	ે
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.976	1.000	0.995	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2255	5	563	700	pc/h

Weaving and Non-Weaving Speeds_____

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.94	1.10
Weaving and non-weaving speeds, Si	32.02	38.77
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 1.16
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S Weaving segment density, D	36.04	mph pc/mi/ln
Level of service, LOS	JZ.50	pc/mi/in
Capacity of base condition, cb	4309	pc/h
±	4204	pc/h
Capacity as a 15-minute flow rate, c	3784	pc/h pc/h
Capacity as a full-hour volume, ch	3/84	ре/п

Limitations on Weaving Segments

·		If Max Exc	eeded See Note	
	Analyzed	Maximum	Note	
Weaving flow rate, Vw	1263	2800	a	
Average flow rate (pcphpl)	1174	2300	. b	
Volume ratio, VR	0.36	0.45	C	
Weaving ratio, R	0.45	N/A	đ	
Weaving length (ft)	500	2500	е	
77				

Notes:

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Diverge Analysis_____

Analyst:

NBS (Alt-4&8 Ex6 NB-Off AM)

Agency/Co.:

VHB

Date performed:

3/19/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&8

Description: FEET I-293

Freeway Data

Type.	oi a	nalysı	S	
Numbe	er of	lanes	in	free
Free.	- £1 0147	gneed	On	free

Free-flow speed on freeway Volume on freeway

Diverge 60.0 2270

mph vph

Off Ramp Data

Side of fr	reeway			
Number of	lanes	in	ramp	
Free-Flow	speed	on	ramp	
Volume on	ramp			

Length of first accel/decel lane Length of second accel/decel lane 35.0 1200

486

Right

mph vph

ft ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?

Volume on adjacent ramp Position of adjacent ramp

Type of adjacent ramp Distance to adjacent ramp Yes 835

vph Downstream

3100

ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2270	1200	835	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	631	333	232	V
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	용
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00	5
Length	0.00 mi	0.00 mi	0.00 π	ni
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
Heavy vehicle adjustment, fHV
                                                   0.990
                                                              0.990
                                       0.976
Driver population factor, fP
                                                   1.00
                                                               1.00
                                       1.00
                                       2585
                                                   1347
                                                               937
                                                                         pcph
Flow rate, vp
                         Estimation of V12 Diverge Areas
                                     (Equation 25-8 or 25-9)
                  L =
                   ΕQ
                  Р
                          0.633
                                     Using Equation 5
                   FD
                          + (v - v) P = 2131
                              F
                                  R
                   12
                              _Capacity Checks____
                                                         LOS F?
                           Actual
                                         Maximum
                                         6900
                                                         No
                           2585
      Fί
                                         4400
                                                         No
                           2131
      12
                                         6900
                                                         No
                           1238
     FO
           F
               R
                                                         No
                           1347
                                         2000
      R
               Level of Service Determination (if not F)
                     D = 4.252 + 0.0086 v - 0.009 L
                                                              18.2
                                                                      pc/mi/ln
Density,
                                           12
Level of service for ramp-freeway junction areas of influence B
                          Speed Estimation_
Intermediate speed variable,
                                             D
                                               = 0.549
                                              S
Space mean speed in ramp influence area,
                                             S = 50.1
                                                          mph
                                              R
Space mean speed in outer lanes,
                                             S = 65.8
                                                          mph
```

S = 52.3

mph

Space mean speed for all vehicles,

VHB, Inc VHB 101 Walnut

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS (Alt-4&9_Ex6_NB-Off_AM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&9

Description: FEET I-293

Freeway	Da	ta
---------	----	----

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2270	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	.1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

vph

Does adjacent ramp exist? Yes
Volume on adjacent ramp 685
Position of adjacent ramp Down

Position of adjacent ramp Downstream
Type of adjacent ramp On

Type of adjacent ramp On
Distance to adjacent ramp 3100 f

Junction Components	Freeway		Ramp		Adjacen Ramp	t
Volume, V (vph)	2270		1200		685	vph
Peak-hour factor, PHF	0.90		0.90		0.90	-
Peak 15-min volume, v15	631		333		190	v
Trucks and buses	5		2		2	용
Recreational vehicles	0		0		0	용
Terrain type:	Level		Level		Level	
Grade	0.00	용	0.00	왕	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2	•	1.2		1.2	

Heavy vehicle adj Driver population Flow rate, vp		1.00	0.990 1.00 1347	0.990 1.00 769	pcph
	Estimation	of V12 Diverge	Areas		
	L = EQ	(Equation 25-8	or 25-9)		
		Using Equation	5		
	v = v + (v - v) 12 R F R	P = 2131 p FD	c/h		
	Capac	ity Checks			
V = V	Actual 2585	Maximum 6900	LOS E No	7?	
Fi F v 12	2131	4400	No		
v = v - v FO F R	1238	6900	No		
v R	1347	2000	No		• .
	Level of Service De	termination (if	not F)		
Density,	D = 4.252 + 0	.0086 v - 0.00	9 L =	18.2	pc/mi/ln
Level of service	for ramp-freeway ju			B	
	Speed E	stimation			
Intermediate spee	d variable,	D = 0 S	.549		
Space mean speed	in ramp influence a		0.1 mph		
Space mean speed	in outer lanes,		5.8 mph		
Space mean speed	for all vehicles,	. S = 5	2.3 mph	:	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

1	m ~	
Diverge	Analy	2212
	* * * * * * * * * * * * * * * * * * *	

Analyst: NBS (Alt-4&10_Ex6_NB-Off_AM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&10

Description: FEET I-293

E	r	e	∋w	ay	. D	a.	t	а	

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2270	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1180	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

vph

Does adjacent ramp exist? Yes
Volume on adjacent ramp 575

Position of adjacent ramp Downstream

Type of adjacent ramp On
Distance to adjacent ramp 3100 ft

Junction Components Freeway		Ramp	Adjacent	
			Ramp	
Volume, V (vph)	2270	1180	575 vpl	1
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	631	328	160 v	
Trucks and buses	5	2	2 %	
Recreational vehicles	0	0	0 %	
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustion for the properties of th		0.976 1.00 2585	0.990 1.00 1324	0.990 1.00 645	pcph
	Estimation	of V12 Diverg	ge Areas		
·	= EQ	(Equation 25	5-8 or 25-	9)	
I		Using Equati	ion 5		•
₹.		P = 2124 FD	pc/h		
	Capac	city Checks			
v = v Fi F	Actual 2585	Maximum 6900	L(OS F?	
v 12	2124	4400	No)	
v = v - v FO F R	1261	6900	N	0	
v R	1324	2000	N))	
Le	evel of Service De	etermination	(if not F)		
Density,	D = 4.252 + 0).0086 v - 0. 12	.009 L :	= 18.1	pc/mi/ln
Level of service fo	or ramp-freeway ju	nction areas	of influe	nce B	
	Speed E	Estimation			
Intermediate speed	variable,	D =	= 0.547		
Space mean speed in	n ramp influence a		= 50.2	mph	
Space mean speed in	n outer lanes,		= 65.8	mph	
Space mean speed fo	or all vehicles,	_	= 52.4	mph	

VHB, Inc VHB 101 Walnut St.

Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysis

Analyst: NBS (Alt-4&8_Ex6_NB-Off_PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&8

Description: FEET I-293

Freeway	Data
---------	------

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4000	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1350	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)____

vph

Does adjacent ramp exist? Yes
Volume on adjacent ramp 1350
Position of adjacent ramp Downstream
Type of adjacent ramp On

Distance to adjacent ramp . 3100 ft

Junction Components	Freeway	Ramp	Adjacent	
			Ramp	
Volume, V (vph)	4000	1350	1350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1111	375	375	v
Trucks and buses	5	2	2	앙
Recreational vehicles	0	0	0	상
Terrain type:	Level	Level	Level	
Grade	0.00 응	0.00 %	0.00 응	
Length	0.00 mi	0.00 mi	0.00 m	i
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjus Driver population f Flow rate, vp		0.976 1.00 4556	0.990 1.00 1515	0.990 1.00 1515	pcph
440.000	Estimation o	of V12 Diverge	e Areas		
	= EQ	(Equation 25		•	
	' = 0.576 FD	Using Equation	on 5		
v		P = 3268 FD	pc/h	·	
	Capaci	ty Checks			
V = V	Actual 4556	Maximum 6900	LOS No	F?	
Fi F V 12	3268	4400	No		•
v = v - v FO F R	3041	6900	No		
v R	1515	2000	No		
Le	vel of Service Det	ermination (:	if not F)	1 . 4 ta - 1 . 4	
Density,	D = 4.252 + 0.	0086 v - 0.0	009 L =	28.0- po	c/mi/ln
Level of service fo	r ramp-freeway jur	oction areas	of influence	e · C · · · · · · · · · · · · · · · · ·	**
	Speed Es	stimation			
Intermediate speed	variable,	D =	0.564		
Space mean speed in	ramp influence ar		49.8 mpl	1 · · · · · · · · · · · · · · · · · · ·	
Space mean speed in	outer lanes,		64.7 mpl	ı	•
Space mean speed fo	or all vehicles,	S =	53.3 mpl	ı	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysi:

Analyst: NBS (Alt-4&9_Ex6_NB-Off_PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&9

Description: FEET I-293

\mathbf{F} :	re	ew	ay	D	a	t	a

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4000	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1350	vph
Length of first accel/decel lane	486	£t
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

On

Yes

1150 vph

Downstream

On

Distance to adjacent ramp 3100 ft

Junction Components	Freeway	Ramp	Adjacent	
			Ramp	
Volume, V (vph)	4000	1350	1150 vph	
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1111	375	319 v	
Trucks and buses	5	2	2 %	
Recreational vehicles	0	0	0 %	
Terrain type:	Level	Level	Level	
Grade	0.00 응	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment Driver population factor Flow rate, vp		0.976 1.00 4556	0.990 1.00 1515	0.990 1.00 1291	pcph
	Estimation	of V12 Dive	rge Areas		
L = EQ		(Equation	25-8 or 25-9))	
P = FD	0.576	Using Equa	tion 5		
v = v 12	r + (v - v) R F R		pc/h		
	Capa	city Checks_			
v = v	Actual 4556	Maximu 6900	m LC No	OS F?	
Fi F V . 12	3268	4400	No		
v = v - v FO F R	3041	6900	No		
V .	1515	2000	No)	
Level o	of Service De	etermination	(if not F)_		****
Density, I	D = 4.252 + 0 R	12	D		pc/mi/ln
Hever or pervise for ra.		Estimation		· .	
	speed	ESCIMACION			
Intermediate speed varia	able,	D S	= 0.564		
Space mean speed in ramp	o influence	area, S R		nph	
Space mean speed in out	er lanes,	S 0		nph	
Space mean speed for all	l vehicles,	S	= 53.3 r	nph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

_____Diverge Analysis

Analyst: NBS (Alt-4&10 Ex6 NB-Off PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&10

Description: FEET I-293

____Freeway Data__

Type of analysis	Diverge	
Number of lanes in freeway	. 3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	4000	vph

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1295	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)

vph

ft

Does adjacent ramp exist? Yes
Volume on adjacent ramp 1035

Position of adjacent ramp Downstream

Type of adjacent ramp
On
Distance to adjacent ramp
3100

____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent
			Ramp
Volume, V (vph)	4000	1295	1035 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	1111	360	288 v
Trucks and buses	5	2	2 %
Recreational vehicles	0	0	0 %
Terrain type:	Level	Level	Level
Grade	0.00 %	0.00 %	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Heavy vehicle adj Driver population Flow rate, vp		1	0.976 L.00 1556	0.990 1.00 1453		0.990 1.00 1162	pcph
	Esti	mation of V	/12 Diverge	Areas			
	L =	(Ec	quation 25-8	3 or 2!	5-9)		•
	EQ P = 0.5 FD	579 Usi	ing Equation	n 5			
	v = v + (12 R	(v - v) P F R FI		oc/h			· ·
		Capacity	Checks			-	
v = v		ctual 556	Maximum 6900		LOS F		•
Fi F v 12	32	250	4400	•	No		
v = v - v FO F R	31	.03	6900		No		
v R	14	153	2000		No		
	Level of Ser	rvice Determ	mination (it	f not 1	₹)		
Density,	D = 4.	252 + 0.008	36 v - 0.00	D D	= 2	27.8	pc/mi/ln
Level of service		eeway junct:		f infl	lence (2	
		_Speed Estir	mation				
Intermediate spee	ed variable,		D = 0 S	0.559			
Space mean speed	in ramp infl	luence area		49.9	mph		
Space mean speed	in outer lar	nes,		64.6	mph	· · · · · · · · · · · · · · · · · · ·	
Space mean speed	for all vehi	icles,	S = !	53.4	mph		

VHB, Inc VHB 101 Walnu

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

	Analysis	
,	,	

Analyst: NBS (Alt-4&9_Ex6_NB-On_AM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB On Ramp

Jurisdiction: NHDOT
Analysis Year: 2035 Build - Alt-4&9

Description: FEET I-293

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1070	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	. 1	•
Free-flow speed on ramp	35.0	mph
Volume on ramp	685	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent Ramp

Position of adjacent Ramp

Type of adjacent Ramp

Distance to adjacent Ramp

3100

Yes

Upstream

Off

3100

ft

Junction Components	Freeway	Ramp	Adjacer Ramp	Adjacent	
Volume, V (vph)	1070	685	1200	vph	
Peak-hour factor, PHF	0.90	0.90	0.90		
Peak 15-min volume, v15	297	190	333	v	
Trucks and buses	5	2	2	용	
Recreational vehicles	0	0	0	왕	
Terrain type:	Level	Level	Level		
Grade	왕	왕		%	
Length	mi	m:	i	mi	
Trucks and buses PCE, ET	1.5	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2	1.2		

Heavy vehicle ad	justment, fHV	0.976	0.990	0.990	
Driver population	n factor, fP	1.00	1.00	1.00	
Flow rate, vp		1219	769	1347	pcph
	Estimation	n of V12 Merge	Areas		
	ID CIMACIO	i or viz nerge			
	L = 208.83 EQ	(Equation 2	5-2 or 25-3)	
		Using Equat	ion 1		
	v = v (P) =	731 pc/h			
	12 F FM				
	Com				
	Capa	acity Checks		í	
	Actual	Maximum	LO	s F?	
v	1988	6900	No		
FO		4.500	3.7	s Š	•
V	1500	4600	No		
R12					
•	Level of Service I	Determination	(if not F)		
		:			
Density, $D = 5.4$	75 + 0.00734 v + 0		.00627 L	= 11.8	pc/mi/ln
R	R	. 12	A		•
Level of service	for ramp-freeway	junction areas	of influen	ce B	•
	Chood	Estimation			. ,
	speed	Estimation			
Intermediate spe	ed variable.	M	= 0.282		
ziiooziiiodzado opo	,	S			
Space mean speed	in ramp influence	area, S	= 54.9 m	ph	
<u> </u>		R			
Space mean speed	in outer lanes,		= 60.0 m	ph	
		0			
Space mean speed	for all vehicles,	S	= 56.1 m	ph	

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst:

NBS (Alt-4&10 Ex6 NB-On AM)

Agency/Co.:

VHB

Date performed: Analysis time period: AM Peak Hour

3/19/2013 Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&10

Description: FEET I-293

F	r	е	e	W	а	У	D	а	t	a	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1090	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	575	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1180	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	.3100	ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1090	575	1180	vph
Peak-hour factor, PHF	0.90	0.90	0.90	1.
Peak 15-min volume, v15	303	160	328	v
Trucks and buses	5	2	2	양
Recreational vehicles	0	0	. 0	%
Terrain type:	Level	Level	Level	
Grade	왕	용		용
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.976 1.00 1241	0.990 1.00 645	0.990 1.00 1324	pcph
	Estimation of	V12 Merge A	Areas		
L = EQ	187.00 (Equation 25	-2 or 25-3)		
	0.600 U	sing Equation	on 1	No saign	
v = v 12 F	(P) = 744 FM	pc/h			
	Capacit	y Checks			
V FO	Actual 1886	Maximum 6900	LOS 1 No	F?	
V R12	1389	4600	No		
Level of	Service Dete	ermination (if not F)		
Density, D = 5.475 + 0.00				11.0	pc/mi/ln
R Level of service for ramp	R -freeway junc	12 tion areas	A of influence	В	
	Speed Est	imation			
Intermediate speed variab	le,	M =	0.281		
Space mean speed in ramp	influence are		54.9 mph	•	
Space mean speed in outer	lanes,		60.0 mph		
Space mean speed for all	vehicles,		56.2 mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Merge Analysis

Analyst: NBS (Alt-4&9 Ex6 NB-On PM)

Agency/Co.: VHB

3/19/2013

Date performed: Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&9

Description: FEET I-293

Freeway Data

T7 - 7	£	_		
Free-flow	speed o	n	freeway	
Number of	lanes i	in	freeway	
Type of ar	narysis			

60.0 2650

Merge

mph

Volume on freeway

vph

mph vph

On Ramp Data

Side of freeway	Right
Number of lanes in ramp	1
Free-flow speed on ramp	35.0
Volume on ramp	1150
Length of first accel/decel lane	800

Length of second accel/decel lane

ft ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes

Volume on adjacent Ramp Position of adjacent Ramp 1350 Upstream vph

Type of adjacent Ramp Distance to adjacent Ramp

Off 3100

Junction Components	Freeway	Ramp	Adjacent Ramp	:
Volume, V (vph)	2650	1150	1350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	•
Peak 15-min volume, v15	736	319	375	v
Trucks and buses	5	2	2	왕
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	· %		양
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad	justment,	fHV	0.97	76	0.990		0.990	
Driver populatio	n factor,	fP	1.00		1.00		1.00	
Flow rate, vp			3018	3	1291		1515	pcph
		Estimatic	n of V12	Merge A	reas			
	L = EQ	705.53	(Equat	ion 25-	2 or 2	5-3)		
	P = FM	0.600	Using	Equatio	n 1			
	v = v 12 F	(P) = FM	1810 g	oc/h				
		Car	acity Che	acka				
		cap	acrey circ	.01.15				
		Actual	Ма	aximum		LOS F	.5	•
v	•	4309	6.9	900		No		
FO								
v R12		3101	46	500		No		
K12								
:	_Level of	Service	Determina	ation (i	f not	F)		
Density, D = 5.4	75 + 0.00	734 v +		- 0.0 L2		= A	24.1	pc/mi/ln
Level of service	for ramp	-freeway	junction	areas o	of infl	uence	C	
		Speed	l Estimati	lon				
								•
Intermediate spe	ed variab	le,		M = S	0.352			mgra = modernost =
Space mean speed	in ramp	influence	area,	S =	53.7	mph		
Space mean speed	in outer	lanes,			57.5	mph		•
Space mean speed	for all	vehicles,		=	54.7	mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Anal	Lys	is

Analyst: NBS (Alt-4&10 Ex6 NB-On PM)

Agency/Co.: VHB

3/19/2013

Date performed: Analysis time period: PM Peak Hour

Freeway/Dir of Travel: I-293 / NB Junction:

Exit 6 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year: 2035 Build - Alt-4&10

Description: FEET I-293

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2705	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	\mathfrak{mph}
Volume on ramp	1035	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

vph

ft .

Does adjacent ramp exist?	Yes
Volume on adjacent Ramp	1295
Position of adjacent Ramp	Upstream
Type of adjacent Ramp	Off
Distance to adjacent Ramp	3100

Junction Components	Freeway	Ramp	Adjace	Adjacent		
		•	Ramp			
Volume, V (vph)	2705	1035	1295	vph		
Peak-hour factor, PHF	0.90	0.90	0.90	_		
Peak 15-min volume, v15	751	287	360	v		
Trucks and buses	5	2	2	용		
Recreational vehicles	0	0	0	%		
Terrain type:	Level	Level	Level			
Grade	%		%	왕		
Length	mi	-	mi	mi		
Trucks and buses PCE, ET	1.5	1.5	1.5			
Recreational vehicle PCE, ER	1.2	1.2	1.2			

Heavy vehicle adj Driver population Flow rate, vp		0.976 1.00 3081	0.990 1.00 1161	0.990 1.00 1453	pcph
	Estimation	n of V12 Merge	Areas		
	L = 691.19 EQ	(Equation 25	-2 or 25-3)		
		Using Equati	on 1		
		1848 pc/h	*.		
	Capa	acity Checks			
v	Actual 4242	Maximum 6900	LOS No	F?	
FO V R12	3009	4600	No		
	Level of Service I	Determination (if not F)		
R.	5 + 0.00734 v + 0 R for ramp-freeway 5	12	A		pc/mi/ln
•	Speed	Estimation		, t	
Intermediate spee	d variable,	M =	0.344		
Space mean speed	in ramp influence		53.8 mpl	n	
Space mean speed	in outer lanes,		57.4 mpl	ı	
Space mean speed	for all vehicles,	S =	54.8 mpl	n.	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

____Diverge Analysis____

Analyst: NBS (Alt-4&9 Ex6 SB-Off AM)

Agency/Co.: VHB

3/19/2013 Date performed: Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / SB

Exit 6 SB Off Ramp Junction:

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&9

Description: FEET I-293

____Freeway Data___

Type of analysis	Diverge			
Number of lanes in freeway	3			
Free-flow speed on freeway	60.0	mph		
Volume on freeway	3005	vph		

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)__

Does adjacent ramp exist? Yes

Volume on adjacent ramp 485 vph

Position of adjacent ramp Downstream Type of adjacent ramp On

Distance to adjacent ramp 4000 ft

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3005		1100		485	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	835		306		135	v
Trucks and buses	4		2		2	왕
Recreational vehicles	0		0		0	양
Terrain type:	Level		Level		Level	
Grade	0.00	ર્ટ -	0.00	용	0.00	왕
Length	0.00 m	ni	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

```
Heavy vehicle adjustment, fHV
                                                                 1.00
Driver population factor, fP
                                        1.00
                                                    1.00
                                        3406
                                                    1234
                                                                 544
                                                                           pcph
Flow rate, vp
                         Estimation of V12 Diverge Areas
                                      (Equation 25-8 or 25-9)
                  L =
                   ΕQ
                                     Using Equation 5
                  Ρ
                          0.618
                   FD
                          + (v - v) P = 2576
                                                   pc/h
                              \mathbf{F}
                                  R
                                       FD
                   12
                               _Capacity Checks__
                                                          LOS F?
                                          Maximum
                           Actual
                           3406
                                          6900
                                                          No
      Fi
                                                          No
                           2576
                                          4400
      12
                                          6900
                                                          No
                           2172
      FO
           F
               R
                           1234
                                          2000
                                                          No ---
      R
                 Level of Service Determination (if not F)_
                       D = 4.252 + 0.0086 v - 0.009 L
                                                               22.0
                                                                        pc/mi/ln
Density,
Level of service for ramp-freeway junction areas of influence C
                            Speed Estimation
                                              D = 0.539
Intermediate speed variable,
                                               S
Space mean speed in ramp influence area,
                                              S = 50.3
                                                           mph
                                               R
Space mean speed in outer lanes,
                                              S = 65.8
                                                           mph
Space mean speed for all vehicles,
                                            S = 53.4
                                                           mph
```

0.980

0.990

0.990

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diver	re A	nal	v	sis
DIVETO		лтат	У ;	コエロ

Analysť: NBS (Alt-4&10 Ex6 SB-Off AM)

Agency/Co.:

VHB

Date performed: Analysis time period:

3/19/2013 AM Peak Hour

Freeway/Dir of Travel: I-293 / SB Junction:

Exit 6 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&10

Description: FEET I-293

Freeway 1	Da	ta
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Type of analysis	Diverge
Number of lanes in freeway	3
Free-flow speed on freeway	60.0 mph
Volume on freeway	2955 vph

Off Ramp Data

Side of freeway	Right	•
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1050	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		£t

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes Volume on adjacent ramp 485 Position of adjacent ramp

Type of adjacent ramp

Distance to adjacent ramp

vph

Downstream

On ft 4000

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2955	1050	485	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	821	292	135	v
Trucks and buses	4 .	2	2	응
Recreational vehicles	0	0	0 5	응
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 왕	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
Heavy vehicle adjustment, fHV
                                                               0.990
                                       0.980
                                                   0.990
Driver population factor, fP
                                       1.00
                                                   1.00
                                                               1.00
                                       3349
                                                   1178
                                                               544
                                                                         pcph
Flow rate, vp
                        Estimation of V12 Diverge Areas
                                     (Equation 25-8 or 25-9)
                 L =
                  EQ
                                    Using Equation 5
                  Ρ
                          0.622
                  FD
                          + (v - v) P = 2529
                           F R
                                     _{
m FD}
                             ___Capacity Checks_
                                                         LOS F?
                                         Maximum
                          Actual
                           3349
                                         6900
                                                         No
     Fi
                                                         No
                           2529
                                         4400
     12
                           2171
                                         6900
                                                         No
     FΟ
          \mathbf{F}
              R
                           1178
                                         2000
                                                         No
     ν
      R
              Level of Service Determination (if not F)_
                     D = 4.252 + 0.0086 v - 0.009 L
                                                              21.6
                                                                      pc/mi/ln
Density,
Level of service for ramp-freeway junction areas of influence C
                     Speed Estimation
                                             D = 0.534
Intermediate speed variable,
                                             S
Space mean speed in ramp influence area,
                                             S = 50.4
                                                          mph
                                             R
Space mean speed in outer lanes,
                                             S = 65.8
                                                          mph
                                             0
Space mean speed for all vehicles,
                                             S = 53.5
                                                          mph
```

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge .	Analy	zsi	Ś
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Analyst: NBS (Alt-4&9_Ex6_SB-Off PM) VHB

Agency/Co.:

Date performed: 3/19/2013 Analysis time period: PM Peak Hour

Freeway/Dir of Travel: I-293 / SB Junction:

Exit 6 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-4&9

Description: FEET I-293

_____Freeway Data_____

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2385	vph

Off Ramp Data

mph
vph
ft
ft

____Adjacent Ramp Data (if one exists)_____

vph

Does adjacent ramp exist? Yes Volume on adjacent ramp 420 Position of adjacent ramp Downstream Type of adjacent ramp On

Distance to adjacent ramp 4000 ft

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	2385	530	420 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	662	147	117 v
Trucks and buses	5	2	2 %
Recreational vehicles	0	0	0 %
Terrain type:	Level	Level	Level
Grade	0.00 %	0.00 %	0.00 용
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Heavy vehicle adjus Driver population f Flow rate, vp		0.976 1.00 2716	0.990 1.00 595	•	0.990 1.00 471	pcph
	Estimation	of V12 Diverg	e Areas_			
	= EQ	(Equation 25	-8 or 25	-9)		
· · · · · · · · · · · · · · · · · · ·	P = 0.665 FD	Using Equati	on 5			
		P = 2005 FD	pc/h			
	Capac	ity Checks				
v = v Fi F	Actual 2716	Maximum 6900		LOS F	?	
v 12	2005	4400	•	No		
v = v - v FO F R	2121	6900	- 1	No		
v R	595	2000		No	•	
Le	evel of Service De	termination (if not F)		
Density,	D = 4.252 + 0	.0086 v - 0.	009 L D	= :	17.1	pc/mi/ln
Level of service fo				ence 1	В	
	Speed E	stimation				
Intermediate speed	variable,	D =	0.482		•	
Space mean speed in	n ramp influence a		51.3	mph		
Space mean speed in	outer lanes,		65.8	mph		
Space mean speed fo	or all vehicles,	· ·	54.5	mph		

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Analyst: NBS (Alt-4&10_Ex6_SB-Off_PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 6 SB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&10

Description: FEET I-293

Freeway Da	ا ـا .	a.
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Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2300	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	470	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)__

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

Distance to adjacent ramp

420 vph

Downstream

On

4000 ft

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	2300	470	420 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	639	131	117 v
Trucks and buses	5	2	2 %
Recreational vehicles	0	0	0 %
Terrain type:	Level	Level	Level
Grade	0.00 %	0.00 %	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Driver population Flow rate, vp	factor,	fP	1.00 2619		.00 27	1.00 471	pcph
		Estimation	of V12 D	iverge A	reas		
	L = EQ	• .	(Equati	on 25-8	or 25-9)		
		0.670	Using E	quation	5		
		+ (v - v) F R	P = 1 FD	929 po	l/h		
		Capac	city Chec	ks	<u> waxayay qayayay qayay ayaan qayaa ayaan ayaa ayaa</u>	wa 100m ocusion was a second	
v = v		Actual 2619	Max 690	imum O	LOS No	F?	•
Fi F V 12		1929	440	0	No		
v = v - v FO F R		2092	690	0	No		
v R		527	200	0	No		
<u>-</u>	Level of	Service De	eterminat	ion (if	not F)		,
Density,		= 4.252 + 0		- 0.009		16.5	pc/mi/ln
Level of service	for ramp	-freeway ju	ınction a	reas of	influence	е В	
		Speed I	Estimatio	n			
Intermediate spee	d variab	ele,		D = 0.	475		
Space mean speed	in ramp	influence a	area,	S = 51 R	4 mpl	a	
Space mean speed	in outer	lanes,		S = 65	.8 mpl	n	
Space mean speed	for all	vehicles,		S = 54	.6 mpl	n	

0.990

0.990

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Merge	Ana	- [7.7	⊂	٦	2
110190	T 77T C	-	γ.	\sim	-	\sim

Analyst: NBS (Alt-4&8 Ex6 SB-On)

Agency/Co.: VBB

Date performed: 3/19/2013 Analysis time period: AM Peak Freeway/Dir of Travel: I-293 / Southbound

Junction: Exit 6 SB On Ramp (Eddy Rd NB)

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&8

Description: I-293 #52196

Freeway D	а	t	а	
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Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3230	vph

On Ramp Data____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1325	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1100	ft

Junction Components	Freeway	Ramp	Adjacen Ramp	t ·
Volume, V (vph)	3230	485	1325	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	897	135	368	v
Trucks and buses	4	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	왕	왕		%
Length	mi	m	i	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle a Driver populati Flow rate, vp	_	1.00 1	.990 .00 14	0.990 1.00 1487	pcph
	Estimation	of V12 Merge Area	as		
	FM	(Equation 25-2 of Using Equation 2196 pc/h			
	Capa	city Checks			
v FO v R12	Actual 4205 2740	Maximum 6900 4600	LOS F No	? · · · · · · · · · · · · · · · · · · ·	
R	Level of Service D 475 + 0.00734 v + 0 R e for ramp-freeway j	.0078 v - 0.006 12 unction areas of	27 L = A		pc/mi/ln
	Speed	Estimation			
Intermediate sp	need variable,	M = 0.3	325 .		
Space mean spee	ed in ramp influence	R	_		
Space mean spee	ed in outer lanes,	S = 56 0 .			in the second se
Space mean spee	ed for all vehicles,	S = 54	.9 mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Me	rqe	Anal	vs	is

Analyst: NBS (Alt-4&9_Ex6_SB-On)

Agency/Co.: VBB

Date performed: 3/19/2013

Analysis time period: AM Peak

Freeway/Dir of Travel: I-293 / Southbound

Junction: Exit 6 SB On Ramp (Eddy Rd NB)
Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-4&9

Description: I-293 #52196

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3230	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	•	ft

_Adjacent Ramp Data (if one exists)____

vph

Does adjacent ramp exist? Yes
Volume on adjacent Ramp 1325

Position of adjacent Ramp Upstream

Type of adjacent Ramp On
Distance to adjacent Ramp 1100 ft

Junction Components	Freeway	Ramp	Adjace	ent
77 7 77 (7.)	2020	405	Ramp	,
Volume, V (vph)	3230	485	1325	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	897	135	368	v
Trucks and buses .	4	2	2	용
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	. %		용	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
1.00
                                                 1.00
                                                             1.00
Driver population factor, fP
                                                 544
                                                             1487
Flow rate, vp
                                     3661
                                                                      pcph
                        Estimation of V12 Merge Areas
                                   (Equation 25-2 or 25-3)
                 L =
                  ΕQ
                                  Using Equation 1
                 P
                         0.600
                  FM
                         (P) = 2196
                       F
                         FM
                  12
                          Capacity Checks
                                                       LOS F?
                         Actual
                                       Maximum
                                                       No
                          4205
                                       6900
    v
     FO
                          2740
                                       4600
                                                       No
     R12
               Level of Service Determination (if not F)
Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =
                                                            21.6
                                                                    pc/mi/ln
Level of service for ramp-freeway junction areas of influence C
                       Speed Estimation
                                           M = 0.325
Intermediate speed variable,
                                            S
                                           S = 54.1
Space mean speed in ramp influence area,
                                                        mph
                                            R
Space mean speed in outer lanes,
                                           S = 56.5
                                                        mph
                                            0
                                              = 54.9
                                                        mph
Space mean speed for all vehicles,
```

0.990

0.990

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Merge Analysis

Analyst: NBS (Alt-4&10 Ex6 SB-On)

Agency/Co.: VBB

Date performed: 3/19/2013 AM Peak Analysis time period:

Freeway/Dir of Travel: I-293 / Southbound

Junction:

Exit 6 SB On Ramp (Eddy Rd NB)

Jurisdiction: NHDOT .

Analysis Year: 2035 Build - Alt-4&10

Description: I-293 #52196

F	'r	е	е	W	a	У	D	а	t	а	•

Type of analysis		Merge	
Number of lanes in freeway		3	
Free-flow speed on freeway	(50.0 m	ıph
Volume on freeway		3180 v	ph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1275 vp	h
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1100 ft	

Junction Components	Freeway	Ramp	Adjacei	nt
			Ramp	
Volume, V (vph)	3180	485	1275	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	883	135	354	v
Trucks and buses	4	2	2	%
Recreational vehicles	0	0	0	ે
Terrain type:	Level	Level	Level	
Grade	양		% .	9
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
Heavy vehicle adjustment, fHV
                                        0.980
                                                     0.990
                                                                 0.990
                                                     1.00
                                                                 1.00
                                        1.00
Driver population factor, fP
Flow rate, vp
                                        3604
                                                     544
                                                                 1431
                                                                           pcph
                          Estimation of V12 Merge Areas_
                   L
                                      (Equation 25-2 or 25-3)
                    ΕQ
                   Р
                           0.600
                                      Using Equation 1
                    FM
                                           pc/h
                           (P) =
                                    2162
                    1.2
                             FM
                             ____Capacity Checks
                            Actual
                                          Maximum
                                                           LOS F?
                            4148
                                           6900
                                                           No
      FO
                            2706
                                           4600
                                                           No
      R12
                 Level of Service Determination (if not F)___
Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L
                                                                         pc/mi/ln
                                                                 21.3
Level of service for ramp-freeway junction areas of influence C
                              Speed Estimation
                                                  = 0.323
Intermediate speed variable,
                                               S
                                                  = 54.2
Space mean speed in ramp influence area,
                                               S
                                                            mph
                                               R
Space mean speed in outer lanes,
                                               S
                                                  = 56.6
                                                            mph
                                               0
                                               S = 55.0
                                                            mph
Space mean speed for all vehicles,
```

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Merge Analysis

Analyst: NBS (Alt-4&8 Ex6 SB-On PM)

Agency/Co.:

VBB

Date performed:

3/19/2013

Analysis time period: PM Peak

Freeway/Dir of Travel: I-293 / Southbound

Junction: Exit 6 SB On Ramp (Eddy Rd NB)
Jurisdiction: NHDOT
Analysis Year: 2035 Build - Alt-4&8

Description: I-293 #52196

F.	r	е	е	W	а	У	D	a	t	а	

Type of analysis	Merge	
Number of lanes in freeway	. 3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2490	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes
Volume on adjacent Ramp	635
Position of adjacent Ramp	Unst

Position of adjacent Ramp Type of adjacent Ramp On

Distance to adjacent Ramp

Upstream 1100

vph

Junction Components	Freeway	Ramp	Adjacer Ramp	ıt
Volume, V (vph)	2490	420	635	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	692	117	176	. v
Trucks and buses	5	2	2	왕
Recreational vehicles	0 .	0	0	왕
Terrain type:	Level	Level	Level	
Grade	왕		용	왕
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad Driver population Flow rate, vp		0.976 1.00 2836	0.990 1.00 471	0.990 1.00 713	pcph
	Estimation	of V12 Mer	ge Areas		And the second s
	L = EQ	(Equation	25-2 or 25-3)	
		Using Equ	ation 1		
	v = v (P) = 12 F FM	1701 pc/h		•	·
	Capa	city Checks			
v FO	Actual 3307	Maxim 6900	ium LC Nc	S F?	
v R12	2172	4600	No)	
	Level of Service I	eterminatio	on (if not F)		
	.75 + 0.00734 v + 0 R	0.0078 v -	0.00627 L A	= 17.2	pc/mi/ln
	e for ramp-freeway j	unction are	eas of influer	ice B	
	Speed	Estimation_			
Intermediate spe	eed variable,	N	I = 0.299 S	, eee	
Space mean speed	l in ramp influence			ıph	
Space mean speed	l in outer lanes,	٤	S = 57.7 m	nph	
Space mean speed	for all vehicles,		S = 55.6 m	ıph	•

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Δna	٦,	VS	÷	S
110190	T-711C	4 .1.	. у 🗀		\sim

Analyst: NBS (Alt-4&9 Ex6 SB-On PM)

Agency/Co.:

VBB 3/19/2013

Date performed:

PM Peak

Analysis time period:

Freeway/Dir of Travel: I-293 / Southbound

Junction:

Exit 6 SB On Ramp (Eddy Rd NB)

Jurisdiction:

NHDOT

#52196

Analysis Year:

2035 Build - Alt-4&9

Description: I-293

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2490	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

___Adjacent Ramp Data (if one exists)____

Does adjacent ramp	exist?		Yes
Volume on adjacent	Ramp		635
Position of adjacer	nt Ramp		Upstrea
Position of adjacer	nc kamp	•	upsi

stream

Type of adjacent Ramp On
Distance to adjacent Ramp 1100

0 ft

vph

Junction Components	Freeway	Ramp	Adjacent	
			Ramp	
Volume, V (vph)	2490	420	635	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	692	117	176	v
Trucks and buses	5	2	2	용
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%		8
Length	. mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
Heavy vehicle adjustment, fHV
                                       0.976
                                                   0.990
                                                               0.990
Driver population factor, fP
                                       1.00
                                                   1.00
                                                               1.00
                                                               713
Flow rate, vp
                                       2836
                                                   471
                                                                         pcph
                         Estimation of V12 Merge Areas
                                     (Equation 25-2 or 25-3)
                  L
                   ΕQ
                                     Using Equation 1
                  Р
                          0.600
                   FM
                          (P) = 1701
                                          pc/h
                        F
                            FM
                   12
                              Capacity Checks_
                                                         LOS F?
                           Actual
                                         Maximum
                           3307
                                         6900
                                                         No.
     FΟ
                           2172
                                         4600
                                                         No
     R12
                Level of Service Determination (if not F)
Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L
                                                               17.2
                                                                       pc/mi/ln
Level of service for ramp-freeway junction areas of influence B
                             Speed Estimation
                                                = 0.299
Intermediate speed variable,
                                              S
Space mean speed in ramp influence area,
                                             S
                                                = 54.6
                                                          mph
                                              R
                                             S
                                                          mph
Space mean speed in outer lanes,
                                                = 57.7
                                              0
Space mean speed for all vehicles,
                                                = 55.6
                                                          mph
```

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Analysis_

Analyst: NBS (Alt-4&10 Ex6 SB-On PM)

Agency/Co.: VBB

Date performed: 3/19/2013 Analysis time period: PM Peak

Freeway/Dir of Travel: I-293 / Southbound

Junction: Exit 6 SB On Ramp (Eddy Rd NB)

Jurisdiction:

NHDOT 2035 Build - Alt-4&10 Analysis Year:

Description: I-293 #52196

F	r	е	e	W	ay	7	D	a	t	a	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2440	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	420	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes Volume on adjacent Ramp 610 vph Position of adjacent Ramp Upstream Type of adjacent Ramp On

Distance to adjacent Ramp 1100 ft

Junction Components	Freeway	Ramp	Adjace Ramp	nt
Volume, V (vph)	2440	420	610	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	678	117	169	v
Trucks and buses	5	2	2	왕
Recreational vehicles	0	0 .	0	%
Terrain type:	Level	Level	Level	
Grade	응		왕	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
Driver population factor, fP
                                                               1.00
                                       1.00
                                                   1.00
                                       2779
                                                   471
                                                               685
                                                                          pcph
Flow rate, vp
                         Estimation of V12 Merge Areas_
                                     (Equation 25-2 or 25-3)
                  L =
                   ΕQ
                                     Using Equation 1
                  Ρ
                          0.600
                   FM
                          (P) = 1667
                                          pc/h
                            FM
                        F
                   12
                              __Capacity Checks__
                                                         LOS F?
                           Actual
                                         Maximum
                           3250
                                         6900
                                                         No
      FO
                                                         No
                                         4600
                           2138
      R12
                Level of Service Determination (if not F)___
Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L
                                                               16.9
                                                                       pc/mi/ln
Level of service for ramp-freeway junction areas of influence B
                       Speed Estimation_
Intermediate speed variable,
                                             M = 0.298
                                              S
Space mean speed in ramp influence area,
                                             S = 54.6
                                                          mph
                                              \mathbb{R}
Space mean speed in outer lanes,
                                             S = 57.8
                                                          mph
                                              0
                                             S = 55.7
Space mean speed for all vehicles,
                                                          mph
```

0.990

0.990

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge	Analys	is
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NBS (Alt-567&9 Ex6 NB-Off AM) Analyst:

Agency/Co.: VHB

Date performed: 3/19/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB Junction: Exit 6 NB Off Ramp

Junction:

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-5,6,7&9

Description: FEET I-293

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	•
Free-flow speed on freeway	60.0	mph
Volume on freeway	2270	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1200	vph
Length of first accel/decel lane	48.6	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes

Volume on adjacent ramp 320 vph

Position of adjacent ramp Downstream Type of adjacent ramp On

Distance to adjacent ramp 1700 ft

Junction Components	Freeway	,	Ramp		Adjace: Ramp	nt
Volume, V (vph)	2270		1200		320	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	631		333		89	v
Trucks and buses	5		2		2	ે
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	왕	0.00	용	0.00	왕
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Driver population Flow rate, vp	factor,	fP	1.00 2585	1.00 1347		1.00 359	pcph
		Estimation o	f V12 Diverge	Areas_			
	L = EQ		(Equation 25-	·8 or 2!	5-9)		
	P = FD	0.633	Using Equatio	on 5		· ·	
	v = v 12 R		P = 2131 FD	pc/h			
		Capaci	ty Checks			·	
v = v Fi F		Actual 2585	Maximum 6900	÷	LOS No	F?	•
v 12		2131	4400		No	$\frac{1}{2\hat{k}_{i}}, \gamma_{i} = \epsilon_{i}$	
V = V - V FO F R		1238	6900		No	, ca	2
v R		1347	2000		No		
	Level of	Service Det	ermination (i	f not 1	₹)		
Density,	D :	= 4.252 + 0.	0086 v - 0.0	009 L D	= -		pc/mi/ln
		Speed Es	timation	·			
Intermediate spee	d variab	le,	D = S	0.549			·
Space mean speed	in ramp	influence ar		50.1	mpł	1	
Space mean speed	in outer	lanes,		65.8	mph	ı	
Space mean speed	for all	vehicles,	S =	52.3	mph	1	

Heavy vehicle adjustment, fHV 0.976 0.990 0.990

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	iv	е	r	q	е	Ana	1	v	s	i	s	

Analyst: NBS (Alt-567&9 Ex6 NB-Off PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-5,6,7&9

Description: FEET I-293

Freeway Data____

Type of analysis	Diverge	
Number of lanes in freeway	3	.•
Free-flow speed on freeway	60.0	mph
Volume on freeway	4000	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1350	. vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

Distance to adjacent ramp

1700

ft

_____Conversion to pc/h Under Base Conditions____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4000	1350	535	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1111	375	149	v
Trucks and buses	5	2	2	8
Recreational vehicles	0	0 .	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00	%
Length	0.00 mi	0.00 mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adj Driver population Flow rate, vp		0.976 1.00 4556	0.990 1.00 1515	0.990 1.00 600	pcph
	Estimation	n of V12 Diverge	e Areas		
	L = EQ	(Equation 25	-8 or 25-9)	•	
		Using Equation	on 5		
		•	pc/h		
	Capa	acity Checks			
v = v Fi F	Actual 4556	Maximum 6900	LOS No	5 F?	
Fi F v 12	3268	4400	No		
V = V - V FO F R	3041	6900	No		
v R	1515	2000	No		
	Level of Service I	Determination (:	if not F)		
Density,	R	0.0086 v - 0.0	D		oc/mi/ln
Level of service	for ramp-freeway	junction areas	of influence	ce C	
	Speed	Estimation			
Intermediate spee	ed variable,	D =	0.564	er de la companya de La companya de la co	
Space mean speed	in ramp influence		-	oh	
Space mean speed	in outer lanes,	R S = 0	64.7 m	ph y	
Space mean speed	for all vehicles,	S =	53.3 mg	oh	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

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NBS (Alt-567&9 Ex6 NB-On1 AM) Analyst:

Agency/Co.: VHB

3/19/2013 Date performed: Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB On Ramp (first ramp)

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-5,6,7&9

Description: FEET I-293

Fr	ee'	way	Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1070	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	320	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?	Yes
Volume on adjacent Ramp	1200
Position of adjacent Ramp	Upstream

Off

vph

Type of adjacent Ramp Distance to adjacent Ramp 1700 ft

Junction Components	Freeway	Ramp	Adjace	nt
			Ramp	
Volume, V (vph)	1070	320	1200	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	297	89	333	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	왕		%	9
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustme	ent, fHV	0.976	0.990	0.990	
Driver population fact	tor, fP	1.00	1.00	1.00	
Flow rate, vp		1219	359	1347	pcph
	Estimation	of V12 Merge	Areas		
-	101 00	/T to ! 0.5	- 0 05 21		
L : EQ		(Equation 25	5-2 or 25-3)		
P FM	0.600	Using Equati	ion 1		
v :		/31 pc/h			
12	F FM				
	Canac	city Checks	•		
	capac	city checks			
	Actual	Maximum	LOS	F?	
V	1578	6900	No		
FO					
v	1090	4600	No		
R12					
T.evre.	l of Service De	etermination	(if not E)		
TIEVE.	T OT PETATCE DE	scerminacion .	(11 1106 1)		
Density, $D = 5.475 + 6$.00627 L =	8.8	pc/mi/ln
R			A	-	
Level of service for :	ramp-freeway ju	inction areas	of influence	e A	
	Speed I	Estimation			
Intermediate speed va	riable.	M =	= 0.277		
· ·		S			
Space mean speed in ra	amp influence a	area, S = R	= 55.0 mp	h	
Space mean speed in or	uter lanes,	S =	= 60.0 mp	h	*
Space mean speed for	all vehicles,	-	= 56.5 mp	h	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Merge	Anal	ysis

Analyst: NBS (Alt-567&9 Ex6 NB-On1 PM)

Agency/Co.: VHB

Date performed: 3/19/2013 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB On Ramp (first ramp)

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-5,6,7&9

Description: FEET I-293

Freeway	Data
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Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2650	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	535	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

__Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1350	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1700	ft

Junction Components	Freeway	Ramp	Adjace	nt -
			Ramp	
Volume, V (vph)	2650	535	1350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	736	149	375	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%		ે	%
Length	mi	•	mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.976 1.00 3018	0.990 1.00 600	0.990 1.00 1515	pcph
I	Estimation of	V12 Merge	Areas		•
L = EQ	557.65 (1	Equation 25	-2 or 25-3)		
	0.600 Us	sing Equation	on 1		
v = v 12 F	(P) = 1810 FM	0 pc/h			
	Canadita	y Checks		i	
	capacit	y Checks	\$ £1		
	Actual	Maximum	LOS	5 F?	
v FO	3618	6900	No		
v R12	2410	4600	No		
Level of	Service Deter	rmination (:	if not F)_	:	
Density, D = 5.475 + 0.007	734 v + 0.00	78 v - 0.0	00627 L =	= 19.0	pc/mi/ln
Level of service for ramp-				ce B	
	Speed Est:	imation			·
Intermediate speed variable	le,	M =	0.308		
Space mean speed in ramp	influence area		54.4 mg	ph	
Space mean speed in outer	lanes,		57.5 m	oh	
Space mean speed for all v	vehicles,	-	55.4 m	ph	

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Anal	ysis

Analyst: NBS (Alt-567&9 Ex6 NB-On2 AM)

Agency/Co.: VHB

Date performed: 3/19/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 6 NB On Ramp (2nd ramp)

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-5,6,7&9

Description: FEET I-293

F	r	е	е	W	ay	· I)a	t	a.	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1390	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	365 .	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)

vph

Does adjacent ramp exist? Yes Volume on adjacent Ramp 320 Position of adjacent Ramp Upstream

Type of adjacent Ramp On

Distance to adjacent Ramp 1700

Junction Components	Freeway	Ramp	Adjacen	t
	•		Ramp	
Volume, V (vph)	1390	365	320	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	386	101	89	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	왕	%		용
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad	justment, fHV	0.976	0.990	0.990	
Driver population	n factor, fP	1.00	1.00	1.00	
Flow rate, vp	· .	1583	410	359	pcph
			_		
	Estimati	on of V12 Merg	ge Areas		
	L = 209.90	(Equation	25-2 or 25-3	B)	
	EQ				
	P = 0.600 FM	Using Equa	ition 1		
	v = v (P) =	950 pc/h	•		
	12 F FM				
	7 -				
	Ca	pacity Checks_			
	Actual	Maximu	ım Lo	OS F?	
v	1993	6900	No		
FO .	•			•	
V	1360	4600	No)	
R12			•		
	Level of Service	Determination	(if not F)		
			(,		
Density, $D = 5.4$	75 + 0.00734 v +		0.00627 L	= 10.9	pc/mi/ln
R		12	A		••
Level of service	for ramp-freeway	Junction area	as of influer	ice B	
	Spee	d Estimation			
	T.				
Intermediate spe	ed variable,		= 0.280		
		-	-	,	
Space mean speed	in ramp influence	•		nph	
Space mean speed	in outer lares	F	=	nph	
space mean speed	III OUCCI IUIICB,			T	
Space mean speed	for all vehicles	s, S	= 56.3	mph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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NBS (Alt-567&9 Ex6 NB-On2 PM) Analyst:

Agency/Co.: VHB

Date performed: 3/19/2013 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 6 NB On Ramp (2nd ramp)

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-5,6,7&9

Description: FEET I-293

Freeway Data

Merge	
3	
60.0	mph
3185	vph
	3 60.0

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	615	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	535	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Junction Components	Freeway	Ramp	Adjacent Ramp	=
Volume, V (vph)	3185	615	535	vph
Peak-hour factor, PHF	0.90	0.90	0.90	_
Peak 15-min volume, v15	885	171	149	v
Trucks and buses	5	2	2	용
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	왕	용		%
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju Driver population Flow rate, vp		0.976 1.00 3627	0.990 1.00 690	0.990 1.00 600	pcph
	Estimation	of V12 Merge	Areas		
	L = EQ	(Equation 25			
	P = 0.600 FM $V = V (P) = 2$ 12 $F FM$	Using Equati 176 pc/h	lon 1		
	Capac	ity Checks			
v FO	Actual 4317	Maximum 6900	LOS No	F?	
v R12	2866	4600	No		
	Level of Service De	termination ((if not F)		
Density, D = 5.475	5 + 0.00734 v + 0. R	0078 v - 0.	.00627 L =	22.5	pc/mi/ln
Level of service	for ramp-freeway ju	nction areas	of influenc	e C	
	Speed E	stimation			
Intermediate speed	d variable,	M =	= 0.334	·	
Space mean speed	in ramp influence a	rea, S =	= 54.0 mp	h	
Space mean speed	in outer lanes,		= 56.6 mp	h	
Space mean speed	for all vehicles,	S =	= 54.8 mp	h	

VHB, Inc VHB 101 Walnut St.

Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	i	v	e	r	q	е	Ana	1	У	s	i	s	

Analyst: NBS (Alt-567&9 Ex6 SB-Off AM)

Agency/Co.: VHB

Date performed: 3/19/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / SB Exit 6 SB Off Ramp

Junction: Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-5,6,7&9

Description: FEET I-293

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	3005	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1100	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)

vph

Does adjacent ramp exist? Yes Volume on adjacent ramp 1810 Position of adjacent ramp

Downstream

Type of adjacent ramp On Distance to adjacent ramp 2100

Junction Components	Freeway	Ramp	Adjacent Ramp	•
Volume, V (vph)	3005	1100	1810	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	835	306	503	v
Trucks and buses	4	2	2	용
Recreational vehicles	0	0	0 .	용
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00	5
Length	0.00 mi	0.00 mi	0.00 т	ni .
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

```
.1.00
Driver population factor, fP
                                     1.00
                                                            1.00
                                                1234
                                                            2031
                                     3406
                                                                     pcph
Flow rate, vp
                       Estimation of V12 Diverge Areas___
                               (Equation 25-8 or 25-9)
                 L =
                 ΕQ
                                 Using Equation 5
                 Ρ
                        0.618
                 FD.
                        + (v - v) P = 2576 pc/h
                          F R
                                  FD
                         ___Capacity Checks__
                                                      LOS.F?
                         Actual
                                       Maximum
                                       6900
                                                      No
                         3406
    v = v
     Fi F
                                       4400
                                                      No
                         2576
     12
                                       6900
                                                      No
                         2172
     FO
          F
              R
                                       2000
                                                      No
                         1234
    v
     R
             Level of Service Determination (if not F)____
                     D = 4.252 + 0.0086 v - 0.009 L =
                                                         22.0 pc/mi/ln
Density,
                                         12
Level of service for ramp-freeway junction areas of influence C
                     Speed Estimation___
Intermediate speed variable,
                                          D = 0.539
                                           S
                                          S = 50.3
Space mean speed in ramp influence area,
                                                       mph
                                           R
                                          S = 65.8
                                                       mph
Space mean speed in outer lanes,
Space mean speed for all vehicles,
                                          S = 53.4
                                                       mph
```

0.990

0.990

Heavy vehicle adjustment, fHV

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	iv	е	r	q	е	Ana	1	У	s	i	s

Analyst: NBS (Alt-567&9 Ex6 SB-Off PM)

Agency/Co.: VHB

Date performed: 3/19/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 6 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-5,6,7&9

Description: FEET I-293

_F,	r	e	e	W	а	Σ	7	D	a	t	a.	

Type of analysis	Diverge .	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2405	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	530	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?
Volume on adjacent ramp
Position of adjacent ramp
Type of adjacent ramp
Distance to adjacent ramp

Yes
1055 vph
Downstream

On 2100

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway		Ramp		Adjacen Ramp	t
Volume, V (vph)	2405		530		1055	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	668		147		293	v
Trucks and buses	5		2		2	%
Recreational vehicles	0		0		0	용
Terrain type:	Level		Level		Level	
Grade	0.00	ે	0.00	응	0.00	%
Length	0.00 r	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE, ER	1.2		1.2		1.2	

Heavy vehicle adjustion for the properties of the second s		0.976 1.00 2739	0.990 1.00 595	0.990 1.00 1184	pcph
	Estimation	of V12 Diver	ge Areas_		
I	. = EQ	(Equation 25	5-8 or 25	-9)	
E		Using Equati	on 5		
	v = v + (v - v) 12 R F R	P = 2019 FD	pc/h		
	Capac	ity Checks		• .	
v = v	Actual 2739	Maximum 6900		LOS F? No	
Fi F V 12	2019	4400		No .	
v = v - v FO F R	2144	6900	J	No _.	
v R	595	2000	. 1	No	
Le	evel of Service De	termination	(if not F)	
Density,	D = 4.252 + 0	.0086 v - 0	.009 L .	= 17.2	pc/mi/ln
Level of service for		nction areas	of influ	ence B	
	Speed E	stimation			
Intermediate speed	variable,	D =	= 0.482		
Space mean speed in	n ramp influence a		= 51.3	mph	
Space mean speed in	outer lanes,		= 65.8	mph	
Space mean speed for	or all vehicles,	S =	= 54.5	mph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Diverge Analysis

Analyst: NBS (Alt-9&4567_Ex7_NB-Off_AM)

Agency/Co.: VHB

Date performed: 3/20/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt-9 & 4,5,6,7

Description: FEET I-293

Freeway Data

Type of analysis Diverge Number of lanes in freeway Free-flow speed on freeway 60.0 mph Volume on freeway 1755 vph

Off Ramp Data

Side of freeway Right Number of lanes in ramp Free-Flow speed on ramp 35.0 mph Volume on ramp 570 vph Length of first accel/decel lane ft 486 Length of second accel/decel lane ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes

Volume on adjacent ramp 305 vph

Position of adjacent ramp Downstream Type of adjacent ramp On

Distance to adjacent ramp 2400

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	1755	570	305 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	487	158	85 v
Trucks and buses	5	2	2 %
Recreational vehicles	0	0	0 %
Terrain type:	Level	Level	Level
Grade	0.00 %	0.00 응	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

```
Driver population factor, fP
                                       1.00
                                                   1.00
                                                               1.00
                                       1999
                                                   640
                                                               342
                                                                         pcph
Flow rate, vp
                        Estimation of V12 Diverge Areas
                                     (Equation 25-8 or 25-9)
                 L =
                  ΕQ
                                    Using Equation 5
                  P
                          0.681
                  FD
                         + (v - v) P = 1565
                            F
                                 R
                                     FD
                   12
                           ____Capacity Checks_
                                                        LOS F?
                          Actual
                                         Maximum
                                         6900
                                                        No
                           1999
          F
     Fi
                                         4400
                                                        No
                           1565
     12
                                         6900
                                                        No
                           1359
      FO
          F
              R
                           640
                                         2000
                                                        No
     v
     Ŕ
               Level of Service Determination (if not F)
                      D = 4.252 + 0.0086 v - 0.009 L
                                                              13.3
                                                                    pc/mi/ln
Density,
Level of service for ramp-freeway junction areas of influence B
                           Speed Estimation_
Intermediate speed variable,
                                             D = 0.486
                                             S
                                             S = 51.3
                                                          mph
Space mean speed in ramp influence area,
                                             R
                                             S = 65.8
                                                          mph
Space mean speed in outer lanes,
Space mean speed for all vehicles,
                                             S = 53.8
                                                          mph
```

0.990

0.990

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

Diverge Analysis_____

Analyst: NBS (Alt-9&4567 Ex7 NB-Off PM)

Agency/Co.:

VHB

Date performed:

3/20/2013 Analysis time period: PM Peak Hour

Junction:

Freeway/Dir of Travel: I-293 / NB

Exit 7 NB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt-9 & 4,5,6,7

Description: FEET I-293

Freeway Data

Type of analysis Number of lanes in freeway Free-flow speed on freeway

Volume on freeway

60.0 3800

Diverge.

mph vph

Off Ramp Data

Side of freeway Right Number of lanes in ramp Free-Flow speed on ramp 35.0

Volume on ramp Length of first accel/decel lane Length of second accel/decel lane 1000 486

mph vph

ft. ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Volume on adjacent ramp

Yes 360

vph

Position of adjacent ramp Type of adjacent ramp

Distance to adjacent ramp

Downstream

On

2400

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3800	1000	360	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1056	278	100	v
Trucks and buses	5	2	2	상
Recreational vehicles	0	0	0	% .
Terrain type:	Level	Level	Level	
Grade	0.00 응	0.00 %	0.00 %	•
Length	0.00 mi	0.00 mi	0.00 m	ni
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju Driver population Flow rate, vp			0.976 1.00 4328	0.990 1.00 1122	0.990 1.00 404	pcph
	Est	imation of	V12 Diverge	Areas_		
	L = EQ	(1	Equation 25-	8 or 25	·-9)	
		600 Us	sing Equation	n 5		
	v = v + 12 R	(v - v) P F R I	= 3046] FD	pc/h		
		Capacity	Checks			
v = v		actual 328	Maximum 6900		LOS F?	
Fi F V	3	046	4400		No	
12 v = v - v FO F R	3	206	6900		No	
v R	. 1	.122	2000	r	No	
· ·	Level of Se	rvice Deter	rmination (i	f not F	·	
Density, Level of service	R		086 v - 0.0 12 cion areas o	D		pc/mi/ln
	• •	Speed Est:	•			
	·					
Intermediate speed	d variable,		D = S	0.529		
Space mean speed :	in ramp inf	luence area		50.5	mph	and the second of the second o
Space mean speed	in outer la	ines,	S = 0		mph	
Space mean speed :	for all veh	nicles,	S =	54.0	mph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysis

Analyst: NBS (Alt-10&4 Ex7 NB-Off AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 10 & 4

Description: FEET I-293

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1665	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	590	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist? Yes
Volume on adjacent ramp 565
Position of adjacent ramp Down

Downstream

vph

Type of adjacent ramp On

Distance to adjacent ramp 2400 ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1665	590	565	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	462	164	157	V
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	용
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00	응
Length	0.00 mi	0.00 mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Driver population Flow rate, vp	factor,	fP	1.00 1896	1. 66	00 2	1.00 634	pcph
Table Large, Sp	· '5	stimation o					
		iscimacion (verge Ar			
	L = EQ		(Equation	on 25-8 c	or 25-9)		
		0.682	Using Ed	quation	5		•
	v = v 12 R	+ (v - v) F R	P = 15 FD	504 pc/	'h		
		Capac	ity Check	s			
		Actual	Maxi	mum	LOS	F?	
V = V Fi F		1896	6900		No		
v		1504	4400)	No		
12							
V = V - V FO F R		1234	6900)	No		
V		662	2000)	No		
R	•						
	Level of	Service De	terminati	on (if r	ot F)		
**************************************	HCACT OT	DCIVICE DC	CCIMIIICC	.011 (11 1			
Density,		4.252 + 0				12.8	pc/mi/ln
Level of service	R for ramp-	freeway in	12 nction a		D nfluence	B	
Hevel of Belvice	ror ramp	·					
		Speed E	stimation	1			
Intermediate spee	d variabl	.e,		D = 0.4	88	•	
Space mean speed	in ramp i	nfluence a	rea,	S = 51.	2 mpl	n , .	
Space mean speed	in outer	lanes,		S = 65.	.8 mpl	1	
Space mean speed	for all v	rehicles,		S = 53	7 mpl	ı	

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

	D	i	v	e	r	g	е	Ana	1	У	S	i	s
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Analyst: NBS (Alt-10&4_Ex7_NB-Off_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 10 & 4

Description: FEET I-293

____Freeway Data_

Type of analysis Diverge
Number of lanes in freeway 3
Free-flow speed on freeway 60.0 mph
Volume on freeway 3740 vph

Off Ramp Data

Side of freeway Right
Number of lanes in ramp 1
Free-Flow speed on ramp 35.0 mph
Volume on ramp 1055 vph
Length of first accel/decel lane 486 ft
Length of second accel/decel lane ft

_____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?

Yes

You was an adjacent ramp

Volume on adjacent ramp 575 vph

Position of adjacent ramp Downstream

Type of adjacent ramp On Distance to adjacent ramp 2400 ft

____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3740	1055	575 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	1039	293	160 v
Trucks and buses	5	2	2 %
Recreational vehicles	0	0	0 %
Terrain type:	Level	Level	Level
Grade	0.00 용	0.00 %	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Driver population factories Flow rate, vp	tor, fP	1.00 4259	1.00	1.00 645	pcph
	Estimation	of V12 Diver	ge Areas		
L EÇ		(Equation 2	5-8 or 25-9	9)	
P FI	= 0.599	Using Equat	ion 5		•
v 12	= v + (v - v)	P = 3026 FD	pc/h		
	Capac	ity Checks			
v = v Fi F	Actual 4259	Maximum 6900	L(OS F?	
v 12	3026	4400	No	o	
V = V - V FO F R	3075	6900	No)	
v R	1184	2000	No		
Leve	el of Service De	termination	(if not F)	:	
Density,	D = 4.252 + 0 R	.0086 v - 0	.009 L :	= 25.9	pc/mi/ln
Level of service for				nce C	
	Speed E	stimation			
Intermediate speed va	ariable,	D S	= 0.535		
Space mean speed in a	amp influence a		= 50.4	mph	
Space mean speed in o	outer lanes,		= 64.9	mph	•
Space mean speed for	all vehicles,	S	= 53.9	nph	

0.976

Heavy vehicle adjustment, fHV

0.990

0.990

HCS2000: Ramps and Ramp Junctions Release 4.1f

VHB, Inc

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Anal	lу	si	s

Analyst: NBS (Alt-9&4567 Ex7 NB-On AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 9 & 4,5,6&7

Description: FEET I-293

Fre	eway	Data
-----	------	------

Merge	
3	
60.0	mph
1185	vph
	3

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	305	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	570	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2400	ft

Junction Components	Freeway	Ramp	Adjacen Ramp	t
Volume, V (vph)	1185	305	570	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	329	85	158	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	. 0	%
Terrain type:	Level	Level	Level	
Grade	왕	왕		8
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adj	ustment, fHV	. (0.976	0.990	0.990	
Driver population	factor, fP	-	1.00	1.00	1.00	
Flow rate, vp		=	1350	342	640	pcph
	Esti	mation of T	V12 Merge A	Areas		
	,		,-		,	
	L = 145 EO	.49 (Ed	quation 25-	-2 or 25	-3)	
	P = 0.6 FM	00 Us:	ing Equatio	on 1		
) = 810 M	pc/h			
	12 F F	I _A I				
		Capacity	Checks			
	Δα	tual	Maximum		LOS F?	
v		92	6900		No	
FÓ						
v	11	52	4600	•	No	
R12						
	Level of Ser	vice Deter	mination (i	if not F	')	
		, 200 2002.			<u></u>	
Density, D = 5.47	5 + 0.00734	v + 0.0078	3 v - 0.0	00627 L A		pc/mi/ln
Level of service	for ramp-fre				_	
	-					
		Speed Estir	mation			
						entropy of the second of the s
Intermediate spee	d variable,		M = S	0.277	,	
Space mean speed	in ramp infl	uence area	, S = R	55.0	mph	
Space mean speed	in outer lan	es,	S =	59.9	mph	
Space mean speed	for all vehi	cles,	0 S =	56.5	mph	e e e e e e e e e e e e e e e e e e e
- · · · · · · · · · · · · · · · · · · ·					4	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merc	re	Ana	1	vs	i.	S
1.10.10		wite		V 10	4	

Analyst:

NBS (Alt-9&4567_Ex7_NB-On_PM)

Agency/Co.:

VHB

Date performed: Analysis time period:

3/20/2013 PM Peak Hour I-293 / NB

Freeway/Dir of Travel: Junction:

Exit 7 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 9 & 4,5,6&7

Description: FEET I-293

F	r	е	e	W	a	v	\mathbf{D}	a	ta	l
		_	-	•••	_			~		•

Type of analysis	Merge
Number of lanes in freeway	3
Free-flow speed on freeway	60.0 mph
Volume on freeway	2800 vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	360	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)__

Yes	
1000	vph
Upstream	
Off	
2400	ft
	1000 Upstream Off

Junction Components	Freeway	Ramp	Adjacen Ramp	.t
Volume, V.(vph)	2800	360	1000	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	778	100	278	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	양	왕		용
Length	mi	m:	i	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad	ljustment, fHV	0.976	0.990	0.990	
Driver population	on factor, fP	1.00	1.00	1.00	
Flow rate, vp		3189	404	1122	pcph
	Estimatior	n of V12 Merge	Areas		·
	L = 552.30	(Equation 2	5_2 or 25_3	2 \	
	EQ 552.30	(Equacion 2	5-2 OI 25-3		
	P = 0.600 FM	Using Equat	ion 1		
		1913 pc/h			
	12 F FM				
	Capa	acity Checks	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	Actual	Maximum	Т.(OS F?	
v	3593	6900	No		
FO				,	
. v	2317	4600	No)	
R12	u				
•	Level of Service I	Determination	(if not F)		
Density $D = 5.4$		•			pc/mi/ln
R	R	12	A		F - , ,
Level of service	e for ramp-freeway	junction areas	of influer	nce B	
	Speed	Estimation			
Intermediate spe	eed variable,		= 0.305		
	lin warm influence	S	= 54.5 r	nn h	
space mean speed	d in ramp influence	R	= 54.5 (nph	
Space mean speed	d in outer lanes,		= 57.2 r	nph	
_		0	F- F- 4	1.	
Space mean speed	d for all vehicles,	. S	= 55.4 r	nph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

~ ~		
Merge	Anal	VSlS

Analyst: NBS (Alt-10&4 Ex7 NB-On AM)

Agency/Co.: VHB

Date performed: 3/20/2013 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB Exit 7 NB On Ramp

Junction: Jurisdiction:

NHDOT Analysis Year: 2035 Build - Alt 10 & 4

Description: FEET I-293

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1075	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	565	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	590	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2400	ft

Junction Components	Freeway	Ramp	Adjacent Ramp	t
Volume, V (vph)	1075	565	590	vph
Peak-hour factor, PHF	0.90	0.90	0.90	_
Peak 15-min volume, v15	299	157	164	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	8
Terrain type:	Level	Level	Level	
Grade	%	%		양
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	*
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju Driver population Flow rate, vp		0.976 1.00 1224	0.990 1.00 634	0.990 1.00 662	pcph
	Estimation o	of V12 Merge	Areas		
	L = 181.01 EQ	(Equation 2	5-2 or 25-3)		
•	P = 0.600 FM	Using Equat	ion 1		
, v	v = v (P) = 73 12 F FM	34 pc/h			
	Capac:	ity Checks	· ·		
V	Actual 1858	Maximum 6900	LOS No	F?	
FO V R12	1368	4600	No	ر ب	
L	evel of Service De	termination	(if not F)		
Density, D = 5.475	+ 0.00734 v + 0.0	0078 v - 0	.00627 L =	10.8	pc/mi/ln
	or ramp-freeway ju			е В	
	Speed E	stimation			·
Intermediate speed	variable,	M S	= 0.280		· · · · · · · · · · · · · · · · · · ·
Space mean speed i	n ramp influence a		= 55.0 mpl	1	
Space mean speed i	n outer lanes,		= 60.0 mph	ı` ·	
Space mean speed f	or all vehicles,		= 56.2 mpl	1 ·	

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Merge Analysis

Fax:

Analyst:	NBS	(Alt-10&4	Ex7	NB-On	PM)

Agency/Co.: VHB

Date performed: 3/20/2013 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction: Exit 7 NB On Ramp

NHDOT

Junction: Jurisdiction: Analysis Year: 2035 Build - Alt 10 & 4

Description: FEET I-293

F,	r	е	е	W	а	v	\perp	a	t	а	
						-					

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2685	vph

_On Ramp Data____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	575	vph
Length of first accel/decel lane	. 800	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)_____

Yes	
1055	vph
Upstream	
Off	
2400	ft
	1055 Upstream Off

Junction Components	Freeway	Ramp	Adjacent Ramp	.
Volume, V (vph)	2685	575	1055	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	746	160	293	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	양	왕		용
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adj Driver population Flow rate, vp		0.976 1.00 3058		990 00 5	0.990 1.00 1184	pcph
	Estimat	cion of V12 N	Merge Area	s		
	L = 575.84 EQ	(Equat:	lon 25-2 o	r 25-3)		
		Using H	Equation	1		
	v = v (P) 12 F FM	= 1834 po	c/h			
		Capacity Chec	cks			***************************************
v FO	Actua 3703		cimum)O	LOS F No	??	
v R12	2479	460	00	No		
	Level of Service	ce Determinat	cion (if n	ot F)		
Density, D = 5.47 R Level of service	R	12	2	A		pc/mi/ln
Hevel of Belvice	_					
	Spe	eed Estimatio	on			
Intermediate spee	d variable,		M = 0.3	12		
Space mean speed	in ramp influer	nce area,	S = 54.	4 mph		
Space mean speed	in outer lanes	,	S = 57.	4 mph		1796
Space mean speed	for all vehicle	es,	S = 55.	3 mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

- ·		
Diverge	Analv	an a
12 11 V C 11 Y C	TITICE A	-

Analyst: NBS (Alt-9&4_Ex7_SB-Off_AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 9 & 4

Description: FEET I-293

	Fre	eway	Data
--	-----	------	------

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2590	vph

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	. 1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	210	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes
Volume on adjacent ramp	625
Position of adjacent ramp	Downstre
Type of adjacent ramp	On

Type of adjacent ramp Distance to adjacent ramp vph wnstream

1200 ft

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	2590	210	625 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	719	58	174 v
Trucks and buses	4	2	2 %
Recreational vehicles	0	0	0 왕
Terrain type:	Level	Level	Level
Grade	0.00 %	0.00 %	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Driver population Flow rate, vp	factor,	fP	1.00 2935	1.00 236	1.00 701	pcph
		Estimation o	of V12 Di	verge Areas		
•	L = EQ		(Equatio	on 25-8 or 2	5-9)	
	P = FD	0.676	Using Eq	uation 5		
	v = v 12 R		P = 20 FD	060 pc/h		
		Capaci	ty Check	s		
v = v		Actual 2935	Maxi 6900		LOS F?	
Fi F V 12		2060	4400)	No	
V = V - V FO F R		2699	6900)	No	
v R		236	2000)	No	· .
	Level of	Service Det	erminati	on (if not	F)	
Density,	R		12	. D		pc/mi/ln
Level of service	for ramp	-freeway jur	etion ar	reas of infl	uence B	
		Speed Es	stimation	1		
Intermediate speed	d variab	le,		D = 0.449		
Space mean speed	in ramp	influence ar	rea,	S = 51.9 R	mph	. •
Space mean speed	in outer	lanes,		S = 65.8	mph	
Space mean speed	for all	vehicles,		S = 55.4	mph	

Heavy vehicle adjustment, fHV 0.980 0.990

0.990

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

HOHE: 617-92

Fax:

E-mail:

_____Diverge Analysis____

Analyst: NBS (Alt-9&4_Ex7_SB-Off_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 9 & 4

Description: FEET I-293

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2310	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	275	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane	•	ft

Adjacent Ramp Data (if one exists)

vph

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

On

On

Type of adjacent ramp On Distance to adjacent ramp 1200 ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2310	275	350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	642	76	97	v
Trucks and buses	5	2	2	응
Recreational vehicles	0	0	0	양
Terrain type:	Level	Level	Level	
Grade	0.00 왕	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	-
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustm Driver population fac Flow rate, vp		0.976 1.00 2631	0.990 1.00 309	0.990 1.00 393	pcph
	Estimation	of V12 Diverg	e Areas		· · · · · · · · · · · · · · · · · · ·
L EQ	=	(Equation 25	-8 or 25-9)	
	= 0.680	Using Equati	on 5		
v 12	= v + (v - v R F R		pc/h		
	Capa	city Checks			
v = v Fi F	Actual 2631	Maximum 6900	LO No	S F?	
v 12	1888	4400	No		
v = v - v FO F R	2322	6900	No	•	,
v R	309	2000	No	•	
Leve	l of Service D	etermination (if not F)_	AMAN MININ M	
Density,	D = 4.252 + R	0.0086 v - 0.	009 L =	16.1	pc/mi/ln
Level of service for				.ce B	
	Speed	Estimation			**************************************
Intermediate speed va	riable,	D =	0.456		
Space mean speed in r	amp influence		: 51.8 m	ph	
Space mean speed in o	uter lanes,	S =	:65.8 m	ıph	
Space mean speed for	all vehicles,	S =	55.1 m	ph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge .	Analy	vsis
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Analyst: NBS (Alt-10&4 Ex7 SB-Off AM)

NHDOT

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB Off Ramp

Jurisdiction:

Analysis Year: 2035 Build - Alt 10 & 4

Description: FEET I-293

$_{ t Free w}$	<i>l</i> ay	Da	ta
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Type of analysis	Diverge	, , , , , , , , , , , , , , , , , , ,
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2690	vph

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	410	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?

Volume on adjacent ramp

Position of adjacent ramp

Type of adjacent ramp

Distance to adjacent ramp

1200

ft

Junction Components	Freeway	Ramp	Ç .	Adjace Ramp	ent
Volume, V (vph)	2690	410		675	vph
Peak-hour factor, PHF	0.90	0.90	D ·	0.90	
Peak 15-min volume, v15	747	114		188	v
Trucks and buses	4	2		2	%
Recreational vehicles	0	0		0	용
Terrain type:	Level	Leve	el	Level	
Grade	0.00	% 0.00	O %	0.00	%
Length	0.00	mi 0.00	O mi	0.00	mi
Trucks and buses PCE, ET	1.5	1.5		1.5	
Recreational vehicle PCE, ER	1.2	1.2		1.2	

Heavy vehicle adjust Driver population fa Flow rate, vp	•	0.980 1.00 3049	0.990 1.00 460	0.990 1.00 758	pcph
	Estimation	of V12 Diver	ge Areas		
L	= EQ	(Equation 2	25-8 or 25-	9)	
P		Using Equat	cion 5		
v	= v + (v - v)) P = 2176 FD	pc/h		
	Capa	city Checks_			
v = v Fi F	Actual 3049	Maximum 6900		OS F?	
v 12	2176	4400	Ŋ	lo ·	
v = v - v FO F R	2589	6900	Ŋ	o	
v R	460	2000	, N	lo	
Lev	vel of Service D	etermination	(if not F)		
Density,	D = 4.252 +	0.0086 v - 0).009 L	= 18.6	pc/mi/ln
Level of service for	- -	 ,		ence B	
	Speed	Estimation			
Intermediate speed	variable,	D S	= 0.469		
Space mean speed in	ramp influence		= 51.6	mph	
Space mean speed in	outer lanes,	s 0	= 65.8	mph	
Space mean speed for	r all vehicles,	S	= 55.0	mph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Div	erae	Anal	vs	is

Analyst: NBS (Alt-10&4_Ex7_SB-Off_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 10 & 4

Description: FEET I-293

Freeway	Data
---------	------

Type of analysis	Diverge	***
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2460	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	535	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?

Volume on adjacent ramp

375

Position of adjacent ramp Downstream

Type of adjacent ramp
Distance to adjacent ramp

On 1200 ft.

vph

Junction Components	Freeway	7	Ramp		Adjace: Ramp	nt
Volume, V (vph)	2460		535		375	vph
Peak-hour factor, PHF	0.90		0.90		0.90	_
Peak 15-min volume, v15	683		149		104	V
Trucks and buses	5		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Level		Level		Level	
Grade	0.00	용	0.00	용	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5		1.5		1.5	
Recreational vehicle PCE. ER	1.2		1.2		1.2	

```
Driver population factor, fP
                                     1.00
                                                 1.00
                                                            1.00
                                     2802
                                                 600
                                                            421
                                                                      pcph
Flow rate, vp
                        Estimation of V12 Diverge Areas
                                   (Equation 25-8 or 25-9)
                 L =
                  ΕQ
                                  Using Equation 5
                 P =
                         0.662
                  FD
                       + (v - v) P = 2058 pc/h
                          F R FD
                            Capacity Checks_
                                                      LOS F?
                                       Maximum
                         Actual
                          2802
                                       6900
                                                      No
        F
     Fi
                                                      No
                          2058
                                       4400
     12
                          2202
                                       6900
                                                     · No
     FO F R
                          600
                                       2000
                                                      No
    v
     R
            Level of Service Determination (if not F)
                   D = 4.252 + 0.0086 v - 0.009 L = 17.6
                                                                   pc/mi/ln
Density,
                                         12
Level of service for ramp-freeway junction areas of influence B
                        Speed Estimation
Intermediate speed variable,
                                           D = 0.482
                                           S
Space mean speed in ramp influence area,
                                           S = 51.3
                                                       mph
                                           \mathbf{R}_{\cdot}
Space mean speed in outer lanes,
                                           S = 65.8
                                                       mph
                                           0
```

S = 54.5

mph

0.976

Heavy vehicle adjustment, fHV

Space mean speed for all vehicles,

0.990

0.990

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

Fax:

E-mail:

__Diverge Analysis____

NBS (Alt-9&567_Ex7_SB-Off_AM) Analyst:

Agency/Co.:

VHB

Date performed:

3/20/2013 Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / SB Junction:

Exit 7 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 9 & 5,6&7

Description: FEET I-293

Fr	e	e١	W	ay	7	D	a	t	a

Type of analysis	Diverge
Number of lanes in freeway	3
Free-flow speed on freeway	60.0 mph
Volume on freeway	2590 vph

Off Ramp Data

Side of freeway	Right	. •	
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	•	mph
Volume on ramp	210		vph
Length of first accel/decel lane	486		ft
Length of second accel/decel lane			ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes

Volume on adjacent ramp

625 vph

Position of adjacent ramp Type of adjacent ramp

Downstream On

Distance to adjacent ramp

1200 ft

Junction Components	Freeway	Ramp	Adjacent	
•		•	Ramp	
Volume, V (vph)	2590	210	625 vph	
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	719	58	174 v	
Trucks and buses	4	2	2 %	
Recreational vehicles	0	0	0 %	
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 용	0.00 %	
Length	0.00 mi	0.00 mi	0.00 mi	
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adj Driver population Flow rate, vp			0.980 1.00 2935	0.990 1.00 236		0.990 1.00 701	pcph
		Estimation o	of V12 Diverg	e Areas			
	L =		(Equation 25	-8 or 2	5-9)		
	EQ P = FD	0.676	Using Equati	on 5			
			P = 2060 FD	pc/h			
		Capac	ity Checks				
v = v		Actual 2935	Maximum 6900		LOS F? No	•	
Fi F V 12		2060	4400		No		,
v = v - v FO F R	·	2699	6900		No	•	
v R		236	2000		No		
,	Level of	Service Det	termination (if not	F)		
Density,	. R		.0086 v - 0.	, D			pc/mi/ln
Level of service	for ramp	-freeway ju	nction areas	of infl	uencé E	3	
		Speed E	stimation				
Intermediate spee	d variab	le,	D =	0.449			
Space mean speed	in ramp	influence a:		51.9	mph		
Space mean speed	in outer	lanes,		65.8	mph		
Space mean speed	for all	vehicles,	S =	55.4	mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

D	i	v	е	r	q	е	Ana	1	У	S	i	s

Analyst: NBS (Alt-9&567_Ex7_SB-Off_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 9 & 5,6&7

Description: FEET I-293

Freeway Da	ı	τ	a	
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Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0 mpl	h
Volume on freeway	2330 vpl	h

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	275	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	350	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1200	ft

Junction Components	Freeway	Ramp	Adjacent. Ramp	
Volume, V (vph)	2330	275	350	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	647	76	97	v
Trucks and buses	5	2	2	왕
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	
Length	0.00 mi	0.00 mi	0.00 m	ii
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle add Driver population Flow rate, vp			0.976 1.00 2654	0.990 1.00 309	0.990 1.00 393) pcph
	Est	imation of	V12 Diverge	Areas		
	L = EQ	(Equation 25-	8 or 2	5-9)	
		679 Ü	sing Equation	n 5		
	$v = v + 12 R_1$	(v - v) F F R	P = 1902] FD	pc/h		
		Capacit	y Checks			
v = v Fi F		ctual 654	Maximum 6900		LOS F? No	
v 12	1	902	4400		No	•
v = v - v FO F R	2	345	6900		No	
v R	3	09	2000		No	
	Level of Se	rvice Dete	rmination (i	f not 1	F)	
Density, Level of service	R	,	1086 v - 0.0 12 tion areas o	D		pc/mi/ln
		_Speed Est	imation			
Intermediate spee	ed variable,	• •.	D = 9	0.456		
Space mean speed	in ramp inf	luence are		51.8	mph	. 4
Space mean speed	in outer la	nes,		65.8	mph	
Space mean speed	for all veh	icles,	S =	55.1	mph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge Analysis

Analyst: NBS (Alt-9&4_Ex7_SB-On_AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build Alt 9&4

Description: FEET I-293

F	r	e	е	W	a	У	\mathbb{D}	a	t	а	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2380	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	625	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	210	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1200	ft

_____Conversion to pc/h Under Base Conditions_____

Junction Components	Freeway	Ramp	Adjacent	5
			Ramp	
Volume, V (vph)	2380	625	210	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	661	174	58	v
Trucks and buses	4	2	2	용
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	%	9		ે
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju	stment, fHV	0.980	0.990	0.990	
Driver population	factor, fP	1.00	1.00	1.00	
Flow rate, vp	•	2697	701	236	pcph
	Estimation	of V12 Merge	Areas		
	L = 510.57 EQ	(Equation 2	5-2 or 25-3)		
		Using Equat	ion 1		
	v = v (P) = 1	1618 pc/h			
	Capa	city Checks			
		 -	Properties of the		
	Actual	Maximum		E.S.	
V	3398	6900	No		
FO ·	2319	4600	No		
R12	2313	4000	110		
			/:5 T)		
L	evel of Service D	etermination	(II HOU F)		
Density, D = 5.475	+ 0.00734 v + 0	.0078 v - 0	.00627 L =	18.2	pc/mi/ln
Level of service f				e B	
	Speed :	Estimation			
Intermediate speed	variable,	M	= 0.305	·	e e e e e e e e e e e e e e e e e e e
Space mean speed i	n ramp influence	· -	= 54.5 mpl	n.	
Space mean speed i	n outer lanes,		= 57.9 mpl	n.	
Space mean speed f	or all vehicles,	=	= 55.6 mpl	ı	

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VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Merge Analysis

Fax:

Analyst:	\mathtt{NBS}	(Alt-9&4	Ex7	SB-On	PM)

Agency/Co.: VHB

Date performed: 3/20/2013 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build Alt 9&4

Description: FEET I-293

		F	r	e	e	Wa	ΣŞ	7	D	a	t	a	
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Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2035	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	350	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	275	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1200	ft

Junction Components	Freeway	Ramp	Adjacent	5
			Ramp	
Volume, V (vph)	2035	350	275	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	565	97	76	v
Trucks and buses	5	2	2	용
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	. %	%		ે
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad	justment, f	HV	0.976	0	.990	0.990	
Driver population	n factor, f	P	1.00	1	.00	1.00	
Flow rate, vp			2318	. 3	93	309	pcph
	Es	stimatio	n of V12 Me	rge Are	as		
				J			
	L = 3 EQ	63.55	(Equatio	n 25-2	or 25-3)		
	P = 0 FM	.600	Using Eq	uation	1		
	v = v (12 F	P) = FM	1391 pc/	h			
		Cap	acity Check	s	4 - 1		
		Actual	Maxi	mum	LOS	F?	
v		2711	6900		No		
FO							
V .		1784	4600		No		
R12							
	Level of S	Service D	Determinati	on (if	not F)		•
Density, D = 5.4						14 2	nc/mi/ln
Density, $D = 5.4$	75 + 0.0073	R	0.0078 V 12	0.000	2 / L - A	11.2	PC/mr/rm
Level of service	for ramp-f		junction ar	eas of	influenc	е В	
	-		_				
		Speed	Estimation				
Intermediate spe	ed variable	1		M = 0	288		
Incermediace ape	ed variable	• 1		s - 0.	200		
Space mean speed	in ramp in	ıfluence	area,		.8 mp	h	
Space mean speed	in outer 1	anes,		R = 58	.5 mp	h	
	1			0 ·			
Space mean speed	for all ve	hicles,		S = 56	.0 mp	h	

Fax:

VHB, Inc

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Analyst: NBS (Alt-10&4 Ex7 SB-On AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-293 / SB

Junction:Exit 7 SB On RampJurisdiction:NHDOTAnalysis Year:2035 Build Alt 10&4

Merge Analysis

Description: FEET I-293

Fr	ee	wa	v	Da	ıta

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2280	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	•
Free-flow speed on ramp	35.0	mph
Volume on ramp	675	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Yes Volume on adjacent Ramp 410 Position of adjacent Ramp

Type of adjacent Ramp Distance to adjacent Ramp Upstream Off 1200 ft

vph

Junction Components	Freeway	Ramp	Adjacer Ramp	nt
Volume, V (vph)	2280	675	410	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min-volume, v15	633	188	114	v
Trucks and buses	4	2	2	બ
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	%		용	%
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjusts	ment, fHV	0.980	0.990	0.	990	
Driver population fac	ctor, fP	1.00	1.00	1.		
Flow rate, vp		2584	758	46	50	pcph
	Estimation	of V12 Merge	Areas			
		·.	•		***************************************	
L E	= 498.59 Q	(Equation 2	5-2 or 25-	-3)		
P Fi		Using Equat	ion 1		* .	
v 1:	= v (P) = 2 F FM	1550 pc/h				
	Capa	city Checks				
						,
•	Actual	Maximum		LOS F?		
V	3342	6900	· r	10		
FO	2308	4600	7	10		
v R12	2300	4000	ı	NO		*
1(12						
Leve	el of Service D	etermination	(if not F)	. :		: ,
	· Allows as sentitely to					
Density, $D = 5.475 +$				= 18	1.1 pc	:/mi/ln
R	R	12	A			
Level of service for	ramp-freeway J	unccion areas	OT THETHE	ence b		
	Speed	Estimation				
	DPCCC.	DOCEMA CEON			2 · .	
Intermediate speed v	ariable, —	M S	= 0.304			·
Space mean speed in	ramp influence		= 54.5	mph		
Space mean speed in	outer lanes,		= 58.1	mph		e a
Space mean speed for	all vehicles,		= 55.6	mph'		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merge	Analysis

Analyst: NBS (Alt-10&4_Ex7_SB-On_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build Alt 10&4

Description: FEET I-293

Freeway	Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1925	vph

On	Ramp	Data
OII	Kamp	Date

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	375	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes
Volume on adjacent Ramp	535 vph
Position of adjacent Ramp	Upstream
Type of adjacent Ramp	Off

Distance to adjacent Ramp 1200 ft

				·
Junction Components	Freeway	Ramp	Adjacent	
<i>></i>			Ramp	
Volume, V (vph)	1925	375	535	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	535	104	149	v
Trucks and buses	5	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	Ş	5	%
Length	mi	n	ni	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	
·				

Heavy vehicle ad Driver population Flow rate, vp			0.976 1.00 2192	0.990 1.00 421		0.990 1.00 600	pcph
		Estimatio	n of V12 Mer	ge Areas			
	L = EQ	•	(Equation		5-3)		•
	P = FM	0.600	Using Equa	ation 1			
	v = v 12 F	(P) = FM	1315 pc/h				
		Cap	acity Checks				
		Actual 2613	Maxim 6900	um	LOS F	?	
v FO		2013			110		
v R12		1736	4600		No		
	_Level of	Service	Determinatio:	n (if not	F)		
Density, D = 5.4	75 + 0.00	734 v +	0.0078 v -		. = A	13.8	pc/mi/ln
Level of service	for ramp	-freeway	junction are	as of infl	uence.	В	
		Speed	Estimation_				
Intermediate spe	ed variab	le,		= 0.287			
Space mean speed	in ramp	influence	· .	= 54.8 R	mph		
Space mean speed	in outer	lanes,	S	= 58.6 0	mph		
Space mean speed	for all	vehicles,	· s	= 56.1	mph		e de la

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS (Alt-9&567_Ex7_SB-On_AM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB On Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 9 & 5,6,7

Description: FEET I-293

__Freeway Data____

Type of analysis	Merge	•
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2380	vph

On Ramp Data____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	625	vph.
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	•	ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	210	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1200	ft

Junction Components	Freewa	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2380	2380		625		vph	
Peak-hour factor, PHF	0.90		0.90		0.90		
Peak 15-min volume, v15	661		174		58	v	
Trucks and buses	4		2		2	%	
Recreational vehicles	0		0		0	앙	
Terrain type:	Level		Level		Level		
Grade		%		용		용	
Length		mi		mi		mi	
Trucks and buses PCE, ET	1.5		1.5		1.5		
Recreational vehicle PCE, EF	ER 1.2		1.2		1.2		

Driver population Flow rate, vp	factor,	fP	1. 26		1.00 701	1	L.00 236	pcph
]	Estimatio	n of V1	2 Merge A	Areas			. ,
	L = EQ	510.57	(Equ	ation 25-	-2 or 2!	5-3)		
•	P = FM	0.600	Usin	g Equatio	on 1			
	v = v 12 F	(P) =	1618	pc/h				
		Cap	acity C	hecks	J			
V FO				Maximum 6900		LOS F?		
v R12		2319		4600		No .		
	Level of	Service	Determi	nation (i	if not 1	F)		
Density, D = 5.47	75 + 0.00	7.34 v +	0.0078	v - 0.0		=	18.2	pc/mi/ln
Level of service	for ramp		junctio				3	
		Speed	Estima	tion				
Intermediate spee	ed variab	le,		M =	0.3.05			
Space mean speed	in ramp	influence	area,		54.5	mph		
Space mean speed	in outer	lanes,		S =	57.9	mph		
Space mean speed	for all	vehicles,		S =	55.6	mph		

0.980

0.990

Heavy vehicle adjustment, fHV

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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1.14	ero	a =	An	a_{\perp}	v 5	1.0	_

Analyst:

NBS (Alt-9&567 Ex7 SB-On PM)

Agency/Co.:

VHB

Date performed: Analysis time period: PM Peak Hour

3/20/2013 Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 9 & 5,6,7

Description: FEET I-293

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Type of analysis	Merge
Number of lanes in freeway	3
Free-flow speed on freeway	60.0 mph
Volume on freeway	2055 vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	350	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	•	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Volume on adjacent Ramp	Yes 275	vph
Position of adjacent Ramp	Upstream	v Dii
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1200	ft

Junction Components	Freeway	Ramp	Adjace: Ramp	nt
Volume, V (vph)	2055	350	275	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	571	97	76	v
Trucks and buses	5	2	2	왕
Recreational vehicles	0	0	0	왕
Terrain type:	Level	Level	Level	
Grade	%		ે .	용
Length	mi		mi	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle ad Driver population Flow rate, vp	•		0.976 1.00 2340	0.990 1.00 393	0.990 1.00 309	pcph
		Estimation o	f V12 Merge	Areas		
	L = EQ	368.26	(Equation 25	-2 or 25-3)		
	P = FM	0.600	Using Equati	on 1		
		(P) = 14	04 pc/h			•
			ty Checks			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
v FO		Actual 2733	Maximum 6900	LOS No	F?	
v R12		1797	4600	No		
	_Level of	Service Det	ermination (if not F)		
Density, D = 5.4	75 + 0.00				14.3	pc/mi/ln
R Level of service	for ramp		12 ction areas	A of influence	e B	
		Speed Es	timation			
Intermediate spec	ed variab	le,	M =	0.289		
Space mean speed	in ramp	influence are	ea, S =	54.8 mph	ι	
Space mean speed	in outer	lanes,		58.4 mph	.	
Space mean speed	for all	vehicles,	-	56.0 mph		

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

M	е	r	g	е	Ana	1	У	S	i	s	

Analyst: NBS (Alt-8&4 Ex7 NB-On AM)

Agency/Co.:

VHB 3/20/2013

Date performed: Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 7 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 8&4

Description: FEET I-293

F	r	е	е	W	a	У	D	a	t	a	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	935	vph

On Ramp Data

Side of freeway	Right	•
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	155	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	•	ft

_Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	970	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2300	ft

Junction Components	Freeway	Ramp	Adjacen Ramp	t
Volume, V (vph)	935	155	970	vph
Peak-hour factor, PHF	0.90	0.90	0.90	~
Peak 15-min volume, v15	260	43	269	v
Trucks and buses	5	2	2	왕
Recreational vehicles	0	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%		양
Length	mi	mi		mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adju Driver population Flow rate, vp		0.976 1.00 1065	0.990 1.00 174	0.990 1.00 1089	pcph
	Estimation	of V12 Merge	Areas		
	EQ	(Equation 2	·		
	P = 0.600 FM	Using Equat	ion 1	,	
		39 pc/h			
	Capac	ity Checks			
· · ·		<u> </u>			
	Actual	Maximum		5 F?	•
V	1239	6900	No		
FO V	813	4600	No		
R12					·
I	Level of Service De	termination	(if not F)_		
Density, D = 5.475	5 + 0.00734 v + 0. R	0078 v - 0	.00627 L =	= 6.7	pc/mi/ln
	for ramp-freeway ju		of influence	ce A	
	Speed E	stimation	•		
	,				
Intermediate speed	d variable,	M. S	= 0.274		
Space mean speed	in ramp influence a	rea, S	= 55.1 mj	oh	
Space mean speed	in outer lanes,		= 60.0 mj	ph	
Space mean speed	for all vehicles,	-	= 56.7 mg	ph	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Merqe Analysi	- 54	

Analyst:

NBS (Alt-8&4 Ex7 NB-On PM)

Agency/Co.:

VHB

Date performed:

3/20/2013

Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-293 / NB

Junction:

Exit 7 NB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 8&4

Description: FEET I-293

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Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2700	vph

On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	160	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1300	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2300	ft

Junction Components	Freeway	Ramp	Adjacent Ramp	:
Volume, V (vph)	2700	160	1300	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	750	44	361	V
Trucks and buses	. 5	2	2	왕
Recreational vehicles	0	0	0	ે
Terrain type:	Level	Level	Level	
Grade	%	ે		왕
Length	mi	mi	Ĺ	mi
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjustion Flow rate, vp		0.9 1.0 307	0	0.990 1.00 180	0.990 1.00 1459	pcph
	Estimati	on of V12	Merge Ar	reas		
	L = 479.97 EQ	(Equa	tion 25-2	2 or 25-3)		•
		Using	Equation	n 1		
	v = v (P) = 12 F FM	1845	pc/h			
	Ca	pacity Ch	ecks			
V FO	Actual 3255		aximum 900	LOS No	F?	
v R12	2025	4	600	No		
	Level of Service	Determin	ation (i	f not F)		
Density, D = 5.47	5 + 0.00734 v +		- 0.00	0627 L =	16.2	pc/mi/ln
Level of service					е В	
3	Spee	d Estimat	ion	·		
Intermediate spee	d variable,	`` 	M = (0.295	•	
Space mean speed	in ramp influenc	e area,	S = ! R	54.7 mpl	n	
Space mean speed	in outer lanes,			57.4 mpl	1	
Space mean speed	for all vehicles	1	S = !	55.7 mpl	n .	

VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge Analysis

Analyst:

NBS (Alt-8&4_Ex7_SB-Off_AM)

Agency/Co.:

VHB

Date performed:

3/20/2013 Analysis time period: AM Peak Hour

Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB Off Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build - Alt 8 & 4

Description: FEET I-293

Freeway Data

Type of analysis		Diverge	
Number of lanes in freeway		3-	
Free-flow speed on freeway		60.0	mpĥ
Volume on freeway	•	2240	vph

Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	260	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)

Does adjacent ramp exist? Volume on adjacent ramp Position of adjacent ramp Type of adjacent ramp

Distance to adjacent ramp

Yes 1025

Downstream

On 2000

ft

vph

Junction Components	Freeway	Ramp	Adjacent
		•	Ramp
Volume, V (vph)	2240	260	1025 vph
Peak-hour factor, PHF	0.90	0.90	0.90
Peak 15-min volume, v15	622	72	285 v
Trucks and buses	4	2	2 %
Recreational vehicles	0	0	0 %·
Terrain type:	Level	Level	Level
Grade	0.00 응	0.00 %	0.00 %
Length	0.00 mi	0.00 mi	0.00 mi
Trucks and buses PCE, ET	1.5	1.5	1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2

Heavy vehicle adjustmen Driver population facto Flow rate, vp		0.980 1.00 2539	0.990 1.00 292	0.990 1.00 1150	pcph
	Estimation of	V12 Diverg	e Areas		
L = EQ	(Equation 25	-8 or 25-9	∍)	
P = FD	0.683 U	sing Equati	on 5		
	v + (v - v) P R F R	= 1827 FD	pc/h		
	Capacit	y Checks			
v = v	Actual 2539	Maximum 6900	L(OS F?	
Fi F V 12	1827	4400	No	0	•
v = v - v FO F R	2247	6900	No	o ·	
v R	292	2000	No	o	
Level	of Service Dete	ermination (if not F)		
Density, Level of service for ra	D = 4.252 + 0.0 R mp-freeway junc	12	D		pc/mi/ln
	Speed Est	imation			
Intermediate speed vari	able,	D =	0.454		
Space mean speed in ram	np influence are	ea, S =		mph	•
Space mean speed in out	er lanes,		65.8	mph	
Space mean speed for al	l vehicles,		: 55.1	mph	

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

Diverge	Analys	is
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Analyst: NBS (Alt-8&4_Ex7_SB-Off_PM)

Agency/Co.: VHB

Date performed: 3/20/2013
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: I-293 / SB

Junction: Exit 7 SB Off Ramp

Jurisdiction: NHDOT

Analysis Year: 2035 Build - Alt 8 & 4

Description: FEET I-293

__Freeway Data_____

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	2120	vph

____Off Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	375	vph
Length of first accel/decel lane	486	ft
Length of second accel/decel lane		ft

_Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist? Yes

Volume on adjacent ramp 650 vph
Position of adjacent ramp Downstream

Type of adjacent ramp On
Distance to adjacent ramp 2000 ft

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2120	-375	650	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	589	104	181	v
Trucks and buses	5	2	2	%
Recreational vehicles	0 .	0	0	ે
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00	ું .
Length	0.00 mi	0.00 mi	0.00 τ	ni
Trucks and buses PCE, ET	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	

Heavy vehicle adjust Driver population fa Flow rate, vp		0.976 1.00 2414	0.990 1.00 421	0.990 1.00 729	pcph
	Estimation o	f V12 Diver	ge Areas		
		(Equation 25	5-8 or 25-	∍)	
P	MQ = 0.680 MD	Using Equat	ion 5		
v	= v + (v - v) .2 R F R	P = 1777 FD	pc/h		
	Capaci	ty Checks			
v = v	Actual 2414	Maximum 6900	N ₀	OS F?	
Fi F V 12	1777	4400	N	0	
v = v - v FO F R	1993	6900	No)	
v R	421	2000	N	O	
Ler	vel of Service Det	ermination	(if not F)		
Density, Level of service for	D = 4.252 + 0. R $ramp-freeway jun$	12	D		pc/mi/ln
		timation			
Intermediate speed v		D :	= 0.466		
Space mean speed in	ramp influence ar	ea, S R	= 51.6	mph	
Space mean speed in	outer lanes,		= 65.8	mph	
Space mean speed for	r all vehicles,	_	= 54.7	mph	

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

 Merge	Analy	sis

Analyst:

NBS (Alt-8&4_Ex7_SB-On_PM)

Agency/Co.:

VHB

Date performed: Analysis time period: PM Peak Hour

3/20/2013 Freeway/Dir of Travel: I-293 / SB

Junction:

Exit 7 SB On Ramp

Jurisdiction:

NHDOT

Analysis Year:

2035 Build Alt 8&4

Description: FEET I-293

F,	r	е	е	W	a	У	D	а	t	а	

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1745	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	650	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)_____

vph

ft

Does adjacent ramp exist?	Yes
Volume on adjacent Ramp	540
Position of adjacent Ramp	Downstream
Type of adjacent Ramp	Off
Distance to adjacent Ramp	1900

Junction Components	Freeway	Ramp		Adjacen Ramp	.t
Volume, V (vph)	1745	650		540	vph
Peak-hour factor, PHF	0.90	0.90		0.90	
Peak 15-min volume, v15	485	181		150	v
Trucks and buses	5	2		2	. %
Recreational vehicles	0	0		0	%
Terrain type:	Level	Level		Level	
Grade	બ		%		왕
Length	mi		mi		mi
Trucks and buses PCE, ET	1.5	1.5		1.5	
Recreational vehicle PCE, ER	1.2	1.2		1.2	

				•		
Heavy vehicle ac	liustment.	fHV	0.976	0.990	0.990	
Driver population			1.00	1.00	1.00	
Flow rate, vp	ii lactor,		1987	729	606	pcph
Frow race, vp	•			125	000	ьсьп
		Estimation o	f V12 Merge	Areas		
	L = EQ	3104.51	(Equation 2)	5-2 or 25-3)		
	P =	0.633	Using Equat.	ion 3		
	FM					
	v = v	(P) = 12	57 pc/h			
	12 F		-		•	
•		Capaci	ty Checks			
		-	-			•
		Actual	Maximum	LOS	F?	
v		2716	6900	No		
FO						
v		1986	4600	No		
R12				*		
			•			
	Level of	Service Det	ermination	(if not F)		
				,		
Density, $D = 5.4$	75 + 0.00	734 v + 0.0	078 v - 0	.00627 L =	15.6	pc/mi/ln
R			12	A		
Level of service	for ramp	-freeway jun	ction areas	of influence	e B	
	-					
•		Speed Es	timation			
		_				
Intermediate spe	ed variab	le,	M	= 0.293		
		•	s			
Space mean speed	l in ramp	influence ar	rea, S	= 54.7 mp	h ·	
-F		* *	R	, •		•
Space mean speed	l in outer	lanes,		= 59.2 mp	h	
Tracepar speed		,	0			
Space mean speed	for all	vehicles.	_	= 55.8 mp	h	
phace mean speed			5			

VHB, Inc VHB

101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS $(A_Alt-4&8_Ex6-7_NB_AM)$

Agency/Co.: VHB

Date Performed: 3/20/2013 Analysis Time Period: AM Peak Hour Freeway/Dir of Travel: I-293 / NB

Weaving Location: Exit 6 to Exit 7

NHDOT

2035 Build Alt 4 & 8

Analysis Year:
Descript: Description: FEET I-293

Inputs_____

·		
Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	4	
Weaving segment length, L	1550	ft
Terrain type	Level	
Grade		용
Length		mi
Weaving type	A	
Volume ratio, VR	0.84	
Weaving ratio, R	0.46	

____Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V	V	V	V	
	A-C	B-D	A-D	B-C	•
Volume, V	200	100	870	735	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	56	28	242	204	v
Trucks and buses	5	2	2	. 2	왕
Recreational vehicles	0	0	0	0	용
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.976	0.990	0.990	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	227	112	976	824	pc/h

_____Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.67	0.33
Weaving and non-weaving speeds, Si	33.76	52.66
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 2.85
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S Weaving segment density, D		mph pc/mi/ln
Level of service, LOS	В	•
Capacity of base condition, cb	6843	pc/h
Capacity as a 15-minute flow rate, c	6676	pc/h
Capacity as a full-hour volume, ch	6008	pc/h

Limitations on Weaving Segments

		If Max Exce	eded See Note
	Analyzed	Maximum	Note
Weaving flow rate, Vw	1800	2800	a
Average flow rate (pcphpl)	534	2300	b
Volume ratio, VR	0.84	0.35	C
Weaving ratio, R	0.46	N/A	d
Weaving length (ft)	1550	2500	e
Notes:	•		•

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

VHB, Inc VHB 101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst: NBS (A_Alt-4&8_Ex6-7_NB_PM)

Agency/Co:: VHB

Date Performed: 3/20/2013

Analysis Time Period: PM Peak Hour
Freeway/Dir of Travel: I-293 / NB
Weaving Location: Exit 6 to Exit 7

Jurisdiction: NHDOT

Analysis Year: 2035 Build Alt 4 & 8

Description: FEET I-293

Inputs

Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	4	
Weaving segment length, L	1550	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.61	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
,	V	V	V	V	
	A-C	B-D	A-D	B-C	
Volume, V	1450	100	1200	1250	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	403	28	333	347	v
Trucks and buses	5 .	2	2	2	왕
Recreational vehicles	0	0	0	0	왕
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.976	0.990	0.990	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1651	112	1346	1402	pc/h

_Weaving and Non-Weaving Speeds__

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.55	0.50
Weaving and non-weaving speeds, Si	29.07	48.24
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 2.50
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Constrained

	Weaving	Segment	Speed,	Density,	Level	of	Service	and	Capacity_	
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/ln

Weaving segment speed, S	34.42	mph
Weaving segment density, D	32.77	pc/mi
Level of service, LOS	D	
Capacity of base condition, cb	6843	pc/h
Capacity as a 15-minute flow rate, c	6676 ·	pc/h
Capacity as a full-hour volume, ch	6008	pc/h

Limitations on Weaving Segments_

		If Max Exce	eded See Note
	Analyzed	Maximum	Note
Weaving flow rate, Vw	2748	2800	a
Average flow rate (pcphpl)	1127	2300	b
Volume ratio, VR	0.61	0.35	C ·
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1550	2500	е
NT a to more			

Notes:

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

VHB, Inc VHB 101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

_Operational	Analy	ysis
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Analyst: NBS (A_Alt-4&8_Ex6-7_SB_AM)

Agency/Co.: VHB

Date Performed: 3/20/2013 Analysis Time Period: AM Peak Hour Freeway/Dir of Travel: I-293 / SB Weaving Location: Exit 6 to Exit 7

NHDOT

Jurisdiction: Analysis Year: 2035 Build Alt 4 & 8

Description: FEET I-293

Inputs

Freeway free-flow speed, SFF Weaving number of lanes, N	60 4	mph
Weaving segment length, L	1600	ft
Terrain type	Level	
Grade		양
Length		mi
Weaving type	A	
Volume ratio, VR	0.64	•
Weaving ratio, R	0.48	

_Conversion to pc/h Under Base Conditions____

•	Non-Weaving		Weaving	Ī	
·	V	V	V	V	
	A-C	B-D	A-D	B∸C	
Volume, V	980	100	1000	925	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	272	28	278	257	v ·
Trucks and buses	4	2	2	2	앙
Recreational vehicles	0	0	0	0	왕
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.980	0.990	0.990	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1110	112	1122	1038	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.96	0.36
Weaving and non-weaving speeds, Si	31.90	51.66
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 2.50

Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40

Type of operation is Constrained

Weaving Segment Speed, Density, Level of Service and Capacity____

Weaving segment speed, S	37.01	mph
Weaving segment density, D	22.84	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	6876	pc/h
Capacity as a 15-minute flow rate, c	6741	pc/h
Capacity as a full-hour volume, ch	6067	pc/h

Limitations on Weaving Segments_

•		If Max Exce	eded See Note
	Analyzed	Maximum	Note
Weaving flow rate, Vw	2.160	2800	a
Average flow rate (pcphpl)	845	2300	b
Volume ratio, VR	0.64	0.35	Ċ
Weaving ratio, R	0.48	N/A	đ
Weaving length (ft)	1600	2500	e
Notes.	•	· ·	

Notes:

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

VHB, Inc VHB 101 Walnut St. Watertown MA

Phone: 617-924-1770

E-mail:

Fax:

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Analyst:

NBS (A_Alt-4&8_Ex6-7_SB_PM)

Agency/Co.:

VHB

Date Performed: Analysis Time Period: PM Peak Hour

3/20/2013 Freeway/Dir of Travel: I-293 / SB

Weaving Location:

Exit 6 to Exit 7

Jurisdiction:

NHDOT

Analysis Year:

2035 Build Alt 4 & 8

Description: FEET I-293

Inputs__

Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	4	
Weaving segment length, L	1600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	. A	
Volume ratio, VR	0.45	
Weaving ratio, R	0.45	

Conversion to pc/h Under Base Conditions

	Non-Wea	ving	Weaving		
	V	V	Λ	V	
	A-C	B-D	A-D	B-C	
Volume, V	1255	50	490	600	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	349	14	136	167	V
Trucks and buses	5	2	2	2	왕
Recreational vehicles	0	0	0	0	양
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.976	0.990	0.990	0.990	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1429	56	549	673	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.21	0.17
Weaving and non-weaving speeds, Si	37.64	57.82
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7) 1.94
Maximum number of lanes, Nw (max) (Exhibit 24-7) 1.40
Type of operation is Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.55	mph
Weaving segment density, D	14.54	pc/mi/ln
Level of service, LOS	В	
Capacity of base condition, cb	6876	pc/h
Capacity as a 15-minute flow rate, c	6708	pc/h
Capacity as a full-hour volume, ch	6037	pc/h

Limitations on Weaving Segments_

		If Max Exc ϵ	If Max Exceeded See Note	
	Analyzed	Maximum	Note	
Weaving flow rate, Vw	1222	2800	a	
Average flow rate (pcphpl)	676	2300	b	
Volume ratio, VR	0.45	0.35	C	
Weaving ratio, R	0.45	N/A	d	
Weaving length (ft)	1600	2500	е	
Notes:		•		

- a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
- b. Capacity constrained by basic freeway capacity.
- c. Capacity occurs under constrained operating conditions.
- d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such
- e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
- f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
- g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such
- h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
- i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.