


MEMORANDUM

**TO:** Kaye Vincent, Lagunitas Companies  
Cathy Mathis, VF Ripley Associates  
Tricia Kroetch, North Star Design  
City of Fort Collins

**FROM:** Matt Delich 

**DATE:** January 11, 2006

**SUBJECT:** Lincoln Mixed-Use Project Transportation Impact Study -  
Adequate Public Facilities analysis of Vine/Lemay  
intersection (File: 0497ME01)

This memorandum addresses the adequate public facilities (APF) issues related to the Vine/Lemay intersection. Historically, this intersection has been problematic due to geometric constraints. In the future, Vine Drive will be moved to the north. When this occurs, it is anticipated that there will not be an APF issue. However, in the interim, analyses are required that address solutions to the APF operational issue.

Currently, the Lemay/Vine intersection has one approach lane on Lemay Avenue, and eastbound and westbound left-turn lanes on Vine Drive. The Lemay/Vine intersection was analyzed both with and without the Lincoln Mixed-Use Project site generated traffic. As shown in Table 1, the Lemay/Vine intersection will meet the City operational standards during the peak hours without the Lincoln Mixed-Use Project site traffic. Calculation forms are provided in Appendix A. With the Lincoln Mixed-Use Project site generated traffic, the subject intersection will operate acceptably in the morning peak hour, but it will not meet the City operational standards in the afternoon peak hour. This is reflected in Table 2. Calculation forms are provided in Appendix B. The increase in delay is greater than 2 percent, even though the increase in traffic is less than 1 percent. Therefore, the impact of the site generated traffic is significant per the City of Fort Collins criteria. Northbound and southbound left-turn lanes would require additional right-of-way and redesign of the railroad crossing. Since the City of Fort Collins Master Street Plan shows the Lemay/Vine intersection shifted to the north with a future grade separated railroad crossing, purchasing right-of-way and upgrading the existing railroad crossing would not be reasonable.

Restriction of northbound and southbound left-turns during the peak hours has been entertained by the City in other transportation impact studies. Analysis of the Lemay/Vine intersection with the left-turn restrictions is shown in Table 3. Calculation forms are provided in Appendix C. The Lemay/Vine intersection will operate acceptably in both the morning and afternoon peak hours with northbound and southbound left-turn restrictions.

If unacceptable operation occurs during one or more peak hours at the Lemay/Vine intersection, the City may implement "no left turn during peak hours" action for the northbound and southbound traffic on Lemay Avenue. This will result in acceptable operation at this intersection.

2272 GLEN HAVEN DRIVE • LOVELAND • COLORADO • 80538

MATTHEW J. DELICH, P. E.

PHONE: 970-669-2061

FAX: 970-669-5034

TRAFFIC & TRANSPORTATION ENGINEERING

TABLE 1 Short Range (2007) Background Peak Hour Operation			
Intersection	Movement	Level of Service	
		AM	PM
Lemay/Vine (signal)	EB LT	C	E
	EB T/RT	C	D
	EB APPROACH	C	D
	WB LT	C	E
	WB T/RT	D	D
	WB APPROACH	D	D
	NB LT/T/RT	B	E
	SB LT/T/RT	D	C
OVERALL	C	D	

TABLE 2 Short Range (2007) Total Peak Hour Operation			
Intersection	Movement	Level of Service	
		AM	PM
Lemay/Vine (signal)	EB LT	C	F
	EB T/RT	C	D
	EB APPROACH	C	E
	WB LT	C	F
	WB T/RT	D	D
	WB APPROACH	D	E
	NB LT/T/RT	B	E
	SB LT/T/RT	D	C
OVERALL	C	E	

TABLE 3 Short Range (2007) Total Peak Hour Operation With No NB/SB Left Turns			
Intersection	Movement	Level of Service	
		AM	PM
Lemay/Vine (signal)	EB LT	C	D
	EB T/RT	C	D
	EB APPROACH	C	D
	WB LT	C	D
	WB T/RT	C	D
	WB APPROACH	C	D
	NB T/RT	B	D
	SB T/RT	C	B
OVERALL	C	D	

# APPENDIX A

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent short long bkgrd total  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR			LTR			LTR	
Volume	35	145	65	110	265	140	20	415	35	90	650	85
Lane Width	12.0	12.0		12.0	12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	P		
Thru	A				Thru	P		
Right	A				Right	P		
Peds	X				Peds	X		
WB Left	A				SB Left	P		
Thru	A				Thru	P		
Right	A				Right	P		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	30.0				60.0			
Yellow	3.0				3.0			
All Red	2.0				2.0			

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	117	377	0.32	0.31	28.1	C		
TR	533	1776	0.43	0.30	28.7	C	28.6	C
Westbound								
L	284	917	0.42	0.31	28.4	C		
TR	530	1766	0.83	0.30	43.3	D	40.1	D
Northbound								
LTR	1046	1743	0.52	0.60	13.4	B	13.4	B
Southbound								
LTR	977	1628	0.97	0.60	41.6	D	41.6	D

Intersection Delay = 33.2 (sec/veh) Intersection LOS = C

2

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent short long bkqrd total  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR			LTR			LTR	
Volume	100	325	85	70	200	145	50	800	120	80	570	40
Lane Width	12.0	12.0		12.0	12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas  
 Signal Operations


Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
WB Left		A			SB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green		29.0				61.0		
Yellow		3.0				3.0		
All Red		2.0				2.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	130	433	0.85	0.30	70.4	E		
TR	523	1805	0.86	0.29	47.2	D	51.8	D
Westbound								
L	97	323	0.85	0.30	79.1	E		
TR	506	1745	0.80	0.29	41.9	D	48.2	D
Northbound								
LTR	1049	1720	1.09	0.61	74.3	E	74.3	E
Southbound								
LTR	859	1408	0.87	0.61	28.2	C	28.2	C

Intersection Delay = 53.9 (sec/veh) Intersection LOS = D

3 

# APPENDIX B

HCS2000: Signalized Intersections Release 4.1e

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent short long bkgrd total  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR		LTR			LTR		
Volume	35	145	65	115	265	140	20	420	40	90	660	85
Lane Width	12.0	12.0		12.0	12.0		12.0			12.0		
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
WB Left		A			SB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green		28.0				62.0		
Yellow		3.0				3.0		
All Red		2.0				2.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/c	Delay	LOS	Delay	LOS
<b>Eastbound</b>								
L	92	316	0.41	0.29	31.6	C		
TR	497	1776	0.46	0.28	30.4	C	30.6	C
<b>Westbound</b>								
L	258	890	0.48	0.29	30.8	C		
TR	494	1766	0.89	0.28	52.6	D	47.7	D
<b>Northbound</b>								
LTR	1080	1742	0.51	0.62	12.3	B	12.3	B
<b>Southbound</b>								
LTR	1009	1628	0.95	0.62	36.4	D	36.4	D

Intersection Delay = 32.8 (sec/veh) Intersection LOS = C

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent short long bkgrd total  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR			LTR			LTR	
Volume	100	325	85	75	200	145	50	810	125	80	575	40
Lane Width	12.0	12.0		12.0	12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds					Peds	X		
WB Left		A			SB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds					Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green		28.0				62.0		
Yellow		3.0				3.0		
All Red		2.0				2.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/c	Delay	LOS	Delay	LOS
Eastbound								
L	117	405	0.94	0.29	99.2	F		
TR	505	1805	0.89	0.28	52.3	D	61.5	E
Westbound								
L	84	291	1.05	0.29	147.3	F		
TR	489	1745	0.83	0.28	45.3	D	63.4	E
Northbound								
LTR	1066	1720	1.09	0.62	73.4	E	73.4	E
Southbound								
LTR	875	1411	0.86	0.62	26.5	C	26.5	C

Intersection Delay = 57.6 (sec/veh) Intersection LOS = E

6



# APPENDIX C

7

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497 (no nb/sb left-turn)  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent (short) long bkgrd (total)  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR			TR			TR	
Volume	35	145	65	115	265	140		420	40		660	85
Lane Width	12.0	12.0		12.0	12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
WB Left		A			SB Left	P		
Thru		A			Thru	P		
Right		A			Right	P		
Peds		X			Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green		34.0				56.0		
Yellow		3.0				3.0		
All Red		2.0				2.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group	Approach	
			v/c	g/C		Delay LOS	Delay LOS
Eastbound							
L	167	477	0.23	0.35	23.7 C		
TR	604	1776	0.38	0.34	25.4 C	25.2	C
Westbound							
L	337	963	0.37	0.35	25.0 C		
TR	600	1766	0.73	0.34	33.7 C	31.7	C
Northbound							
TR	1031	1841	0.51	0.56	15.4 B	15.4	B
Southbound							
TR	1027	1834	0.83	0.56	26.2 C	26.2	C

Intersection Delay = 24.9 (sec/veh) Intersection LOS = C

8 47

Analyst: Joseph  
 Agency: Matthew J. Delich, P.E.  
 Date: 12/6/04  
 Period: am pm  
 Project ID: 0497 no nb/sb left-turn  
 E/W St: Vine Street

Inter.: Lemay/Vine  
 Area Type: All other areas  
 Jurisd: Fort Collins  
 Year : recent short long bkgrd total  
 N/S St: Lemay Avenue

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	0	0	1	0	0	1	0
LGConfig	L	TR		L	TR			TR			TR	
Volume	100	325	85	75	200	145		810	125		575	40
Lane Width	12.0	12.0		12.0	12.0			12.0			12.0	
RTOR Vol			0			0			0			0

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left			
Thru		A			Thru P			
Right		A			Right P			
Peds					Peds X			
WB Left		A			SB Left			
Thru		A			Thru P			
Right		A			Right P			
Peds					Peds X			
NB Right					EB Right			
SB Right					WB Right			
Green		31.0				59.0		
Yellow		3.0				3.0		
All Red		2.0				2.0		

Cycle Length: 100.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	155	485	0.71	0.32	43.9	D		
TR	560	1805	0.80	0.31	40.0	D	40.8	D
Westbound								
L	122	381	0.72	0.32	48.8	D		
TR	541	1745	0.75	0.31	36.8	D	39.0	D
Northbound								
TR	1079	1829	1.02	0.59	52.9	D	52.9	D
Southbound								
TR	1090	1847	0.61	0.59	15.7	B	15.7	B

Intersection Delay = 39.3 (sec/veh) Intersection LOS = D

9 *ES*