

Appendix D: Design Criteria and Cost Estimates



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K-10 Transportation Study

Table D-1: Roadway Design Criteria (see Section 5.1)

Design Feature	KDOT Design Criteria - Freeways					City Design Criteria - Arterials					APWA Design Criteria - Arterials		
	Mainline		Ramps			Lawrence		Lenexa		Olathe			
	Desirable	Minimum	Regular (at gore)		Loop	Principal	Minor	7-lane	5-lane	Major	Minor	Major	Minor
			Entrance	Exit	Minimum								
Access Control	Full		Full			Full		--	--	--	--	--	--
Design Vehicle	WB-50 (Ck WB-62)		WB-50 (Ck WB-62)			WB-50 (Ck WB-62)		--	--	--	--	--	--
Design Speed (mph)	75	70	50	55	25	50	40	45-50	35-45	50	45	50	40
Typical Section													
Lane Width (ft)	12		16 (1 lane), 12 each (2 or more lanes)			--		--	--	--	--	--	--
<i>Shoulder Width (ft)</i>													
Outside (Rt.)*	10		8	8	8	--	--	--	--	--	--	--	--
Inside (Lt.)*	10		1 lane - 2 (with or without CSB); 2 or more lanes - 4 (no CSB) or 6 (with CSB)			4		--	--	--	--	--	--
Outside Ramp Terminals (ft)	--	--	--	--	--	12	12	12	12	12	12	12	12
Inside Ramp Terminals (ft)	--	--	--	--	--	12	12	12	12	12	12	12	12
Alignment													
<i>Percent Grade</i>													
Minimum	0.5%	0.3%	0.5% (0.3% min.)	0.5% (0.3% min.)	0.5% (0.3% min.)	5.0	5.0	1.0	1.0	0.8	0.8	1.0	1.0
Maximum	3.0%		5.0%	5.0%	5.0%	0.5	0.5	6.0	6.0	5.0	6.0	6.0	7.0
Intersection Sight Distance (ft)	--	--	--	--	--	560 (170 m)	560 (170 m)	--	--	215	215	--	--
Min. Stopping Sight Dist. (ft)	865	730	425	495	155	430 (130 m)	430 (130 m)	--	--	400-475	325-400	-----as per AASHTO-----	
<i>Min. K Value</i>													
Sag Vertical	206	181	96	115	26	96	96	--	--	96	79	90-110	60-70
Crest Vertical	312	247	84	114	12	84-114	84-114	--	--	84	61	110-160 or 60-80	40-50
<i>Horizontal Curvature**</i>													
Minimum Radius (ft)	2870		760	965	170	760	760	850	680	750	500	1091	700
Max Superelevation (%)***	7.2	N/A	8.0	8.0	8.0	--	--	--	--	--	--	--	--
Normal Crown (%)	--	--	--	--	--	1.6	1.6	--	--	2.0	--	--	--
<i>Vertical Clearance</i>													
Over highways & local roads w/ I/C (ft)	16' 4"		16' 4"	16' 4"	16' 4"	16' 4"	16' 4"	--	--	16' 4"	16' 4"	--	--
Railway separation (ft)	23' 6"		23' 6"	23' 6"	23' 6"	--	--	--	--	--	--	--	--
Over local roads (ft)	15' 4"		15' 4"	15' 4"	15' 4"	15' 4"	15' 4"	--	--	15' 4"	15' 4"	--	--
Minimum Radius (ft)										50	50	35-50	35
Minimum ROW Width (ft)	--		--	--	--	100	100	132-200	100-120	120	100	100-150	80
Curb Return Radii (ft)	N/A		N/A	N/A	N/A	--	--	--	--	--	--	--	--
Clear Zone (ft)	35	35	25 (22 min.)	25	25 (17 min.)	--	--	--	--	--	--	--	--

Notes:

Design Criteria based on 2001 AASHTO Green Book

Sidestreets will be designed to Olathe City standards

* Rt. & Lt. Is referenced looking in the direction of traffic.

** Desired maximum superelevation is 6.0%

*** Use emax = 8% AASHTO table

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Table D-2: Cost Estimates (\$2004) [support data for Table 5-3]

Mainline	Unit	Cost/Unit	Lawrence to Douglas/ Johnson County Line		Douglas/Johnson County Line to K-7		K-7 to Renner		Total Study Area
			Quantity	Cost	Quantity	Cost	Quantity	Cost	
Concrete Pavement (12") (AE) (NRDJ)*	sq. yd.	\$42	472647	\$19,851,164	552097	\$23,188,066	259985	\$10,919,382	\$53,958,612
Concrete Pavement (12" variable) (AE) (Plain)*	sq. yd.	\$38	236390	\$8,982,820	304414	\$11,567,745	74158	\$2,818,004	\$23,368,569
Lime (Hydrated)	ton	\$95	11182	\$1,062,290	11091	\$1,053,645	4223	\$401,185	\$2,517,120
Manipulation (Lime Treated Subgrade)	sq. yd.	\$3	767630	\$2,302,890	910914	\$2,732,742	346789	\$1,040,367	\$6,075,999
Water (Lime Treated Subgrade)	Mgal	\$4,165	14	\$58,310	15.95	\$66,432	6	\$25,282	\$150,023
Cement Treated Base (4")	sq. yd.	\$8	767630	\$6,141,040	910914	\$7,287,311	346789	\$2,774,312	\$16,202,663
Total Pavement Costs				\$38,398,514		\$45,895,940		\$17,978,531	\$102,272,985
Mainline Bridge Improvements	lump sum	variable	6	\$1,836,000	18	\$7,290,000	1	\$3,060,000	\$12,186,000
Earthwork (25%)				\$9,599,628		\$11,473,985		\$4,494,633	\$25,568,246
Drainage (5%)				\$1,919,926		\$2,294,797		\$898,927	\$5,113,649
Pavement Marking (3%)				\$1,151,955		\$1,376,878		\$539,356	\$3,068,190
Traffic Control (18%)				\$6,911,733		\$8,261,269		\$3,236,136	\$18,409,137
Miscellaneous (8%)				\$3,071,881		\$3,671,675		\$1,438,283	\$8,181,839
Total Quantities Costs				\$62,889,637		\$80,264,545		\$31,645,865	\$174,800,047
25% Contingency				\$15,722,409		\$20,066,136		\$7,911,466	\$43,700,012
Improvements to Ex. Interchanges	see below			\$18,563,240		\$28,189,587		\$126,591,848	\$173,344,675
Total Construction Costs				\$97,175,287		\$128,520,268		\$166,149,179	\$391,844,734
Utilities (5%)				\$1,919,926		\$2,294,797		\$898,927	\$5,113,649
ROW (See table below)	sq. ft.	variable	2122803	\$1,013,000	6302582	\$5,113,072	7819841	\$17,594,642	\$23,720,714
Engineering (24.5%)				\$23,807,945		\$31,487,466		\$40,706,549	\$96,001,960
Total Costs				\$123,916,158		\$167,415,603		\$225,349,297	\$516,681,057

* Includes Franklin side streets.

New "As Requested" Interchanges	Unit	Cost/Unit	Franklin Crossroad Over		Winchester Crossroad Over		Prairie Star Crossroad Over		Clare Crossroad Over		Lone Elm Crossroad Over		Total New Intchgs
			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	
9" PCCP (Ramps)	sq. yd.	\$42	15312	\$643,120	13120	\$551,045	46410	\$1,949,203	27697	\$1,163,273	32640	\$1,370,882	\$5,677,522
Base (Drainable) (4")	sq. yd.	\$5	15312	\$76,562	13120	\$65,601	46410	\$232,048	27697	\$138,485	32640	\$163,200	\$675,895
6" Lime Treated Subgrade	sq. yd.	\$8	15312	\$122,499	13120	\$104,961	46410	\$371,277	27697	\$221,576	32640	\$261,120	\$1,081,433
Cross-road Reconstruction	yd.	variable	547	\$620,750	656	\$546,116	766	\$700,700	656	\$1,177,800	821	\$1,111,500	\$4,156,866
Guardfence; St PI	yd.	\$50	87	\$4,350	87	\$4,350	87	\$4,350	87	\$4,350	87	\$4,350	\$21,750
Guardfence End Terminal	each	\$1,600	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	\$23,000
Bridge	lump sum	variable	1	\$1,632,000	1	\$1,055,700	2	\$1,502,800	1	\$2,774,400	1	\$3,847,500	\$10,812,400
Subtotal				\$3,105,681		\$2,334,173		\$4,766,777		\$5,486,283		\$6,764,952	\$22,457,867
Earthwork (45%)				\$1,397,557		\$1,050,378		\$2,145,050		\$2,468,827		\$3,044,228	\$10,106,040
Drainage (5%)				\$155,284		\$116,709		\$238,339		\$274,314		\$338,248	\$1,122,893
Pavement Marking (3%)				\$93,170		\$70,025		\$143,003		\$164,588		\$202,949	\$673,736
Traffic Control (18%)				\$559,023		\$420,151		\$858,020		\$987,531		\$1,217,691	\$4,042,416
Miscellaneous (8%)				\$248,455		\$186,734		\$381,342		\$438,903		\$541,196	\$1,796,629
Total Quantities Costs				\$5,559,170		\$4,178,169		\$8,532,531		\$9,820,447		\$12,109,264	\$40,199,581
25% Contingency				\$1,389,792		\$1,044,542		\$2,133,133		\$2,455,112		\$3,027,316	\$10,049,895
Total Construction Costs				\$6,948,962		\$5,222,712		\$10,665,664		\$12,275,559		\$15,136,580	\$50,249,476
Utilities				\$300,000		\$200,000		\$300,000		\$600,000		\$900,000	\$2,300,000
ROW				\$600,000		\$200,000		\$100,000		\$1,300,000		\$2,600,000	\$4,800,000
Engineering				\$1,500,000		\$1,100,000		\$1,700,000		\$3,100,000		\$4,400,000	\$11,800,000
Total Cost				\$9,348,962		\$6,722,712		\$12,765,664		\$17,275,559		\$23,036,580	\$69,149,476

Improvements to Existing Interchanges	Unit	Cost/Unit	Lawrence to Douglas/Johnson County Line						Douglas/Johnson County Line to K-7						K-7 to Renner											
			1900 Road Crossroad Over		Church Street Crossroad Over		1400 Road		Evening Star Crossroad Over		Edgerton Crossroad Under		Lexington Crossroad Under		Kill Creek Crossroad Under		Mize/Cedar Creek Crossroad Under		K-7 Crossroad Over		Woodland Crossroad Under		Ridgeview Crossroad Under		Renner Crossroad Under	
			Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
9" PCCP (Ramps)	sq. yd.	\$42	12265	\$515,129	15736	\$660,902	12852	\$539,793	22057	\$926,379	15509	\$651,358	30514	\$1,281,569	17610	\$739,616	14975	\$628,955	185180	\$7,777,571	18363	\$771,262	29840	\$1,253,288	75471	\$3,169,790
Base (Drainable) (4")	sq. yd.	\$5	12265	\$61,325	15736	\$78,679	12852	\$64,261	22057	\$110,283	15509	\$77,543	30514	\$152,568	17610	\$88,050	14975	\$74,876	185180	\$925,901	18363	\$91,817	29840	\$149,201	75471	\$377,356
6" Lime Treated Subgrade	sq. yd.	\$8	12265	\$98,120	15736	\$125,886	12852	\$102,818	22057	\$176,453	15509	\$124,068	30514	\$244,108	17610	\$140,879	14975	\$119,801	185180	\$1,481,442	18363	\$146,907	29840	\$238,722	75471	\$603,770
Cross-road Reconstruction	yd.	variable	547	\$262,500	766	\$367,500	0	\$0	766	\$366,100	547	\$226,000	865	\$212,779	656	\$373,200	656	\$211,800	766	\$366,100	547	\$226,000	547	\$226,000	547	\$226,000
Guardfence; St PI	yd.	variable	87	\$4,400	87	\$4,367	87	\$4,208	87	\$4,208	87	\$4,208	252	\$12,190	87	\$4,208	87	\$4,208	87	\$4,208	87	\$4,208	87	\$4,208	87	\$4,208
Guardfence End Terminal	each	\$1,600	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	1	\$1,600	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400	4	\$6,400
CSB	ft	\$70										1250	\$87,500													
Impact Attenuator	each	\$30,000										1	\$30,000													
Bridge	lump sum	variable	1	\$2,700,000	1	\$2,700,000						1	\$960,000	1	\$2,268,000	1	\$2,088,000	1	\$32,385,000			1	\$858,000	1	\$4,134,000	
Retaining Wall	lump sum	variable										1	\$1,287,000													
Roundabout		variable					2	\$200,000																		
C/D Roads & Braided Ramps		variable																60518	\$3,036,000							
Pvmt Marking (Epoxy) (4")	yd.	\$1	5262	\$5,262	5262	\$5,262	4810	\$4,810	5262	\$5,262	5262	\$5,262	13327	\$13,327	5262	\$5,262	5262	\$5,262	5262	\$5,262	5262	\$5,262	5262	\$5,262	8752	\$8,752
Subtotal				\$3,653,136		\$3,948,996		\$922,290		\$1,595,085		\$1,094,840		\$4,282,641		\$3,625,615		\$3,139,302		\$45,987,885		\$1,251,856		\$2,741,081		\$8,530,276
Earthwork (45%)				\$1,643,911		\$1,777,048		\$415,030		\$717,788		\$492,678		\$850,961		\$1,631,527		\$1,412,686		\$20,694,548		\$563,335		\$1,233,487		\$2,132,569
Drainage (5%)				\$182,657		\$197,450		\$46,114		\$79,754		\$54,742		\$94,551		\$181,281		\$156,965		\$2,299,394		\$62,593		\$137,054		\$426,514
Traffic Control (18%)				\$657,564		\$710,819		\$166,012		\$287,115		\$197,071		\$340,384		\$652,611		\$565,074		\$8,277,819		\$225,334		\$493,395		\$1,535,450
Miscellaneous (8%)				\$292,251		\$315,920		\$73,783		\$127,607		\$87,587		\$342,611		\$290,049		\$251,144		\$3,679,031		\$100,149		\$219,287		\$682,422
Total Quantities Costs				\$6,429,519		\$6,950,234		\$1,623,230		\$2,807,350		\$1,926,918		\$5,911,149		\$6,381,083		\$5,525,171		\$80,938,678		\$2,203,267		\$4,824,303		\$13,307,230
25% Contingency				\$1,607,380		\$1,737,558		\$215,319		\$701,837		\$481,729		\$1,477,787		\$1,595,271		\$1,381,293		\$20,234,669		\$550,817		\$1,206,076		\$3,326,807
Total Costs				\$8,036,899		\$8,687,792		\$1,838,549		\$3,509,187		\$2,408,647		\$7,388,936		\$7,976,353		\$6,906,464		\$101,173,347		\$2,754,084		\$6,030,379		\$16,634,037

Right-of-Way Cost Assumptions	Area (ft²)	Est. Cost per Unit (ft²)	Cost of ROW	Area (ft²)	Est. Cost per Unit (ft²)	Cost of ROW	
Mainline***				New Interchanges			
Lawrence City Limits (West of K-10 Ext)	1,143,008	\$0.60	\$685,805	Franklin	925,695	\$0.60	\$555,417
Eudora City Limits (Winchester to 1400)	457,466	\$0.60	\$274,479	Winchester</			