

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			Lawrence to Douglas/ Johnson County Line		Douglas/Johnson County Line to K-7		K-7 to Renner		Total Study Area
	Unit	Cost/Unit	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			Franklin Crossroad Over		Winchester Crossroad Over		Prairie Star Crossroad Over		Clare Crossroad Over		Lone Elm Crossroad Over		Total New Intchgs
	Unit	Cost/Unit	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 (5%)				\$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			Lawrence to Douglas/Johnson County Line				Douglas/Johnson County Line to K-7						K-7 to Renner													
	Unit	Cost/Unit	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	
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	Mainline***			New Interchanges			
	Area (ft ²)	Est. Cost per Unit (ft ²)	Cost of ROW	Area (ft ²)	Est. Cost per Unit (ft ²)	Cost of ROW	
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	312,993	\$0.60	\$187,796
Rural Douglas County	522,329	\$0.10	\$52,233	Prairie Star Pkwy	232,091	\$0.60	\$139,