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ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

November 17, 1992

Mr. David C. Spears, P.E.
Director, Sedgwick County
Bureau of Public Services
1250 S. Seneca
Wichita, KS 67213-4498

Attention: Harlan Foraker, P.E.

Reference: Boeing Industrial Addition
PEC File No. 36-92400-31-196

Dear Mr. Spears:

Transmitted herewith are two (2) copies of the Drainage Plan and supporting computations for the referenced project. We would like to ask you to review and approve this Drainage Plan on or before the November 23, closing date for scheduling of a hearing before the Subdivision Committee of the Metropolitan Area Planning Commission.

If there are any questions, please advise.

Very truly yours,

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Michael W. Berry

Michael W. Berry, P.E.
Manager
Land Development Division

MWB:ama

Encl: As noted

cc: Boeing Company w/Attachments

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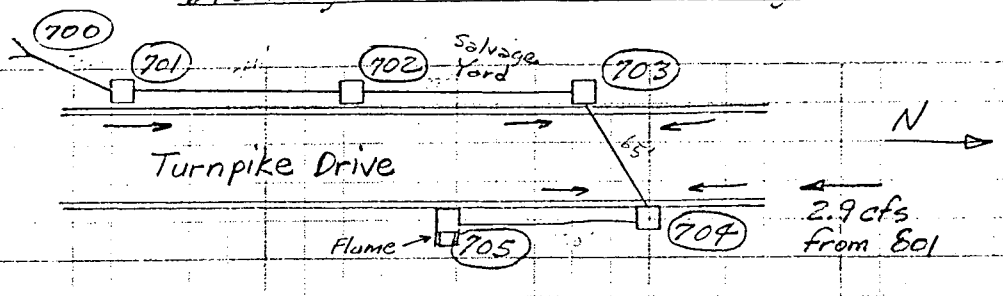
Project Turnpike Drive Improvements

Item Drainage Calculations - System #700



I. HYDROLOGY

Rational Formula $Q = CiA$

Design system for 100-yr. storm
Try to keep overflow out of salvage yard

Determine C_{100}:

Node #	Area (Acres)	Soil Type	Hydr. Soil Group	Land Use	C_{100}
705	2.3	Uc	B	5% Street 95% Undev. Urb.	0.93 (0.05)(0.93) 0.68 + (0.95)(0.68) = 0.69
704	1.7	Uc	B	Paved Street	0.93
703	0.3	Uc	B	Paved Street	0.93
702	0.2	Uc	B	Paved Street	0.93
701	0.6	Uc	B	Paved Street	0.93
700	Headwall				

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Determine T_c (100-yr.)

Node 705 - Overland Flow - 550'
704 - Gutter Flow - 1800'
703 - Gutter Flow - 350'
702 - Gutter Flow - 250'
701 - Gutter Flow - 550'

Node #	S	n	L	S_x	A
705	0.5%	0.030	550'	—	2.3 Ac.
704	1.6%	0.013	1800'	0.03125	1.7 Ac.
703	0.4%	0.013	350'	0.03125	0.3
702	0.4%	0.013	250'	0.03125	0.2
701	0.9%	0.013	550'	0.03125	0.6
700	Headwall				

Node #704

From HEC-12, Chart 2, p.18

Try T = 16 ft. → V = 5.5 ft/sec.

$L/V = 1800/5.5 = 327$ sec = 5.5 min. → Use $T_c = 15$ min.

Node #703

Use T = 16 ft → V = 2.9 ft/sec.

$L/V = 350/2.9 = 121$ sec = 2 min → Use $T_c = 15$ min.

SYSTEM #700

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Item Drainage Calculations - System #700

Determine T_c (cont.)

Node #702

Use $T = 16$ ft $\longrightarrow$ $V = 2.9$ ft/sec

$L/V = 250/2.9 = 86.2$ sec $= 1.4$ min $\longrightarrow$ Use $T_c = 15 + 0$ min.

Node #701

Use $T = 16$ ft $\longrightarrow$ $V = 4.3$ ft/sec

$L/V = 550/4.3 = 127.9$ sec. $= 2.1$ min $\longrightarrow$ Use $T_c = 15 + 0$ min

Node #705 - Overland Flow

from HEC-12, Chart 1, p. 16:

Try $i = 2$ in/hr. $\longrightarrow$ $T_c = 18.6$ min $\longrightarrow$ $i = 6.74$

$i = 0.5$ in/hr $\longrightarrow$ $T_c = 32.3$ min $\longrightarrow$ $i = 5.20$

Does not converge $\longrightarrow$ Use $T_c = 5$ minutes (minimum)

No gutter flow $\therefore$ $T_c = 5$ min $+ 0$ min $= 5$ min.

Use $T_c = 15$ minutes

Check: $i \times l = 10.32 \times 550 = 5676 > 500$ OK

Node #700 - Headwall.

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Item Drainage Calculations - System #700

Select Intensity "i" 100-yr. storm

Node #	T_c (Minutes)	"i" (in/hr)
705	15	7.37
704	15	7.37
703	15	7.37
702	15	7.37
701	15	7.37
700	Headwall	

Compute "Q" 100-yr. storm

Node #	C	i	A	Q_{100}
705	0.69	7.37	2.3	11.7 cfs
704	0.93	7.37	1.7	11.7
703	0.93	7.37	0.3	2.1
702	0.93	7.37	0.2	1.4
701	0.93	7.37	0.6	4.1
700	Headwall			

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Project Turnpike Drive Improvements

Item Drainage Calculations - System # 700

II. INLET CAPACITY

HEC 12 Charts 9 & 10

Node #	Inlet Condition	Inlet Size	Qapproach	Qintercept *	Qbypass	To Node
705	On Grade	10'	11.7 E=0.42	4.9	6.8	704
704	Sump	10'	2.9+11.7+6.8=21.4 (From Node 705)	21.4	—	—
703	Sump	5'	2.1 + 2.8 = 4.9	4.9	—	—
702	On Grade	5'	2.9+1.4=4.3 E=0.36	1.5	2.8	703
701	On Grade	5'	4.1 E=0.32	1.2	2.9	703
700	(Headwall)					

*Q used for "Storm" computer program.

Check Ponding Depths

Node #	Q_{100}	Inlet Size	d_i	d	dallowable	Comment
704	21.4	10'	0.90	0.73	0.54'	Overflow will Enter inlet #705.
703	4.9	5'	0.38	0.21	0.54'	OK

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Item Drainage Calculations - System #700

II. STREET FLOW

Check flooded width @ Node 704

Max. allowable flooded width = 16 ft.

Compute Q_{max} & compare to $Q_{704\ Actual} = 15.8$

From H.E.C. 12, Chart 3, p. 23, compute Q_s:

$T = 16$ ft.
$T_s = 14$ ft.

$\rightarrow Q_s n = 0.22 \rightarrow Q_s = 16.9$ cfs

From Chart 4, p. 25,

$W/T = 2/16 = 0.1250$

$S_w/S_x = 0.0750/0.03125 = 2.4$

$\rightarrow E_o = 0.33$

$\therefore Q_{max} = \underbrace{Q_s/(1-E_o)}_{Ch.\ 3} = 16.9/(1-0.33) = 25.2$ cfs

21.4 cfs < 25.2 cfs OK

Check flooded upstream of Node 703:

$Q_{703} = 2.1 < 25.2$ OK

SYSTEM 800

SYSTEM 900

SYSTEM 1000

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Project Turnpike Drive Improvements

Item Drainage Calculations - System # 700

III. STREET FLOW con't

Check flooded width upstream of Node 702

$Q_{appr.} = Q_{702} + Q_{by\ 701} = 1.4 + 2.9 = 4.3$ cfs

$S_o = 0.004$ $S_x = 1/32$ $n = 0.013$

Compute capacity @ max. flooded width (Chart 3, HEC 12)

$T = 16'$ $T_s = 14'$

$Q_s n = 0.12$ $Q_s = 9.2$ cfs

(Chart 4 HEC 12)

$W/T = 2/16 = 0.125$ $Sw/S_x = 0.075/0.03125 = 2.4$

$E_o = 0.33$ $Q_{max} = Q_s/(1-E_o) = 13.7$

$Q < Q_{max}$ OK

At Node 701

$Q_{701} = 4.1 < Q_{max}$ OK

At Node 705

Only 10%± Q in Street

$Q_{705} = 0.10\ (11.7) = 1.2$ cfs $< Q_{max}$ OK by inspection

Date: 02-11-1991
Time: 09:24:58

Input File: turn700

TURNPIKE DRIVE SWS SYSTEM NO. 700

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node to Node		C	Area (Ac)	Slope (%)	Length (Ft)	TC(@) (Min)	I(@) (In/Hr)	Q(@) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
705	704	0.69	3.30	0.00	0.0	15.00	8.97	4.93	15.00	8.97	4.90	4.90	24"	1.56	120.00	1.28	16.28
704	703	0.93	2.20	0.00	0.0	15.00	8.97	21.40	15.00	8.97	21.40	25.91	30"	5.28	65.00	0.21	15.21
703	702	0.93	0.30	0.00	0.0	15.00	8.97	4.90	15.21	8.93	4.87	30.79	30"	6.27	235.00	0.62	15.83
702	701	0.93	0.20	0.00	0.0	15.00	8.97	1.50	15.83	8.79	1.47	32.26	36"	4.56	240.00	0.89	16.71
701	700	0.93	0.60	0.00	0.0	15.00	8.97	1.20	16.71	8.60	1.15	33.41	36"	4.73	200.00	0.71	17.41

SYSTEM 008

Date: 06-11-1991
Time: 08:04:56

Input File: turn700

TURNPIKE DRIVE SWS SYSTEM NO. 700

Storm Frequency = 100-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
701	0.38251	0.5018	0.0000	0.0023	0.0000	0.0000	0.0592	0.5633	1314.0632	1321.1000	7.04
702	0.00234	0.5613	0.0000	0.0575	0.0000	0.0000	-0.2185	0.4003	1314.4636	1320.1100	5.65
703	0.00563	1.3241	0.0000	0.0178	0.0000	0.1600	0.3809	1.8829	1316.3464	1319.2600	2.91
704	0.00399	0.2595	0.0000	0.0395	0.0000	0.0214	1.0095	1.3299	1317.6763	1319.1801	1.50
705	0.00047	0.0563	0.0000	0.0000	0.0000	0.0000	0.0000	0.0563	1317.7325	1319.5499	1.84
700	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1313.5000	1313.5000	0.00