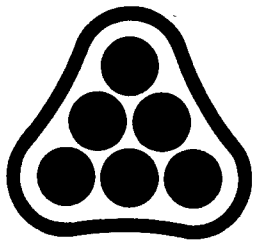

PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

FOR

BROADWAY 47 PLAZA 2ND ADDITION

TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
ENGINEERS
WICHITA, KANSAS

MARCH 27, 1987

1440 EAST ENGLISH
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Date March 26, 1987 Page 1 of 10

Project Broadway - 47 Plaza 2nd Add.

Item Drainage Plan.

I HYDROLOGY

Use Rational Method $Q = cIA$

Use 5-yr & 100-yr storms for analysis.

Use t_c = 15 min. (all nodes)

NODE	C	I_5	A	Q_5
103	1.0	4.56	3.57	16.3
102	1.0	4.56	1.94	8.8
101	0.95	4.56	4.40	19.1

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Project Broadway 47 Plaza

Item Drainage Plan

II FLOOD ROUTING

Node 103

$Q_{approach}$ = 16.3 cfs

Assume Inlet Control

$Q = CA\sqrt{2gh}$

C = 0.6
A = 1.33 SF (Std 2x2 Grate)
g = 32.2 fps²
h = 1.2'

$Q = 0.6 \times 1.33\sqrt{2 \times 32.2 \times 1.2}$

Q = 7.0 cfs

$Q_{intercept}$ = 7.0

Q_{bypass} = 16.3 - 7.0 = 9.3 to Node 102

Node 102

$Q_{approach}$: 8.8
+ 9.3
18.1

Inlet Control

$Q = CA\sqrt{2gh}$

C = 0.6
A = 1.33 SF (Std 2x2 Grate)
g = 32.2 fps²
h = 0.5'

$= 0.6 \times 1.33\sqrt{2 \times 32.2 \times 0.5}$

$Q_{int.}$ = 4.5

Q_{bypass} = 18.1 - 4.5 = 13.6 cfs to Node 100

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Project Broadway - 47 Plaza 2nd Addition

Item Drainage Plan

Node 101

$Q_{approach} = 19.1$

Future curb inlet on grade $s = \pm 0.32\%$

$L_T = 37'$ (See chart Attached)

$L_{actual} = 5'$

$L/L_T = 5/37 = 0.135$

Efficiency = 22%

$Q_{int.} = .22 \times 19.1 = 4.2$

$Q_{bypass} = 19.1 - 4.2 = 14.9$ cfs to Node 100

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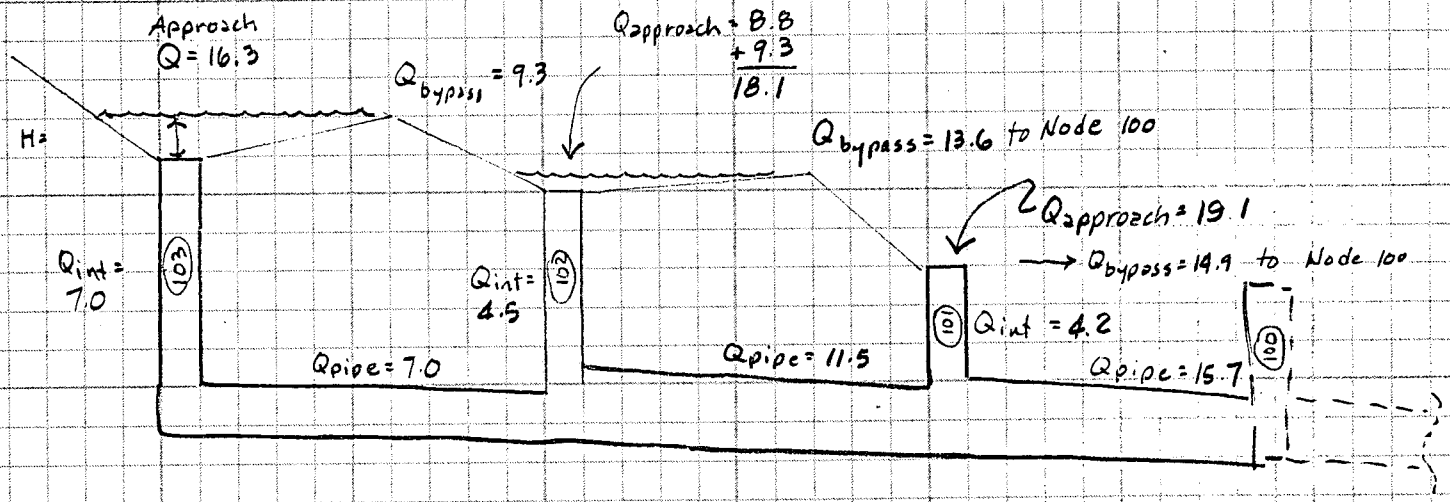
Date March 26, 1987 Page 4 of 10

Project Broadway - 47 Plaza 2nd Add

Item Drainage Plan

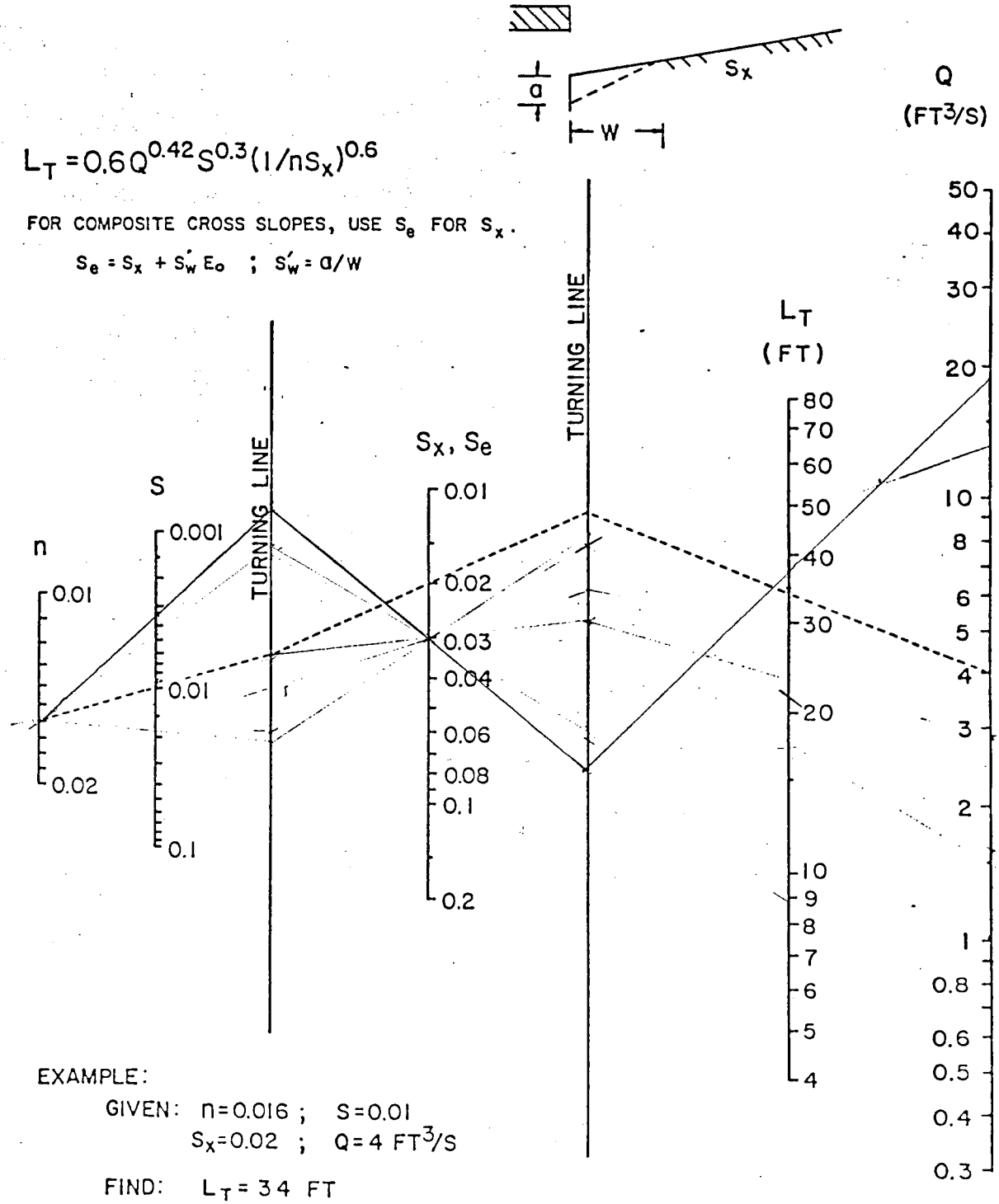


5/10

$$L_T = 0.6 Q^{0.42} S^{0.3} (1/nS_x)^{0.6}$$

FOR COMPOSITE CROSS SLOPES, USE S_e FOR S_x.

$S_e = S_x + S'_w E_o$; $S'_w = a/W$



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$

$S_x = 0.02$; $Q = 4$ FT³/S

FIND: $L_T = 34$ FT

CHART 9. Curb-opening and slotted drain inlet length for total interception.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAR. 1984.

6.10

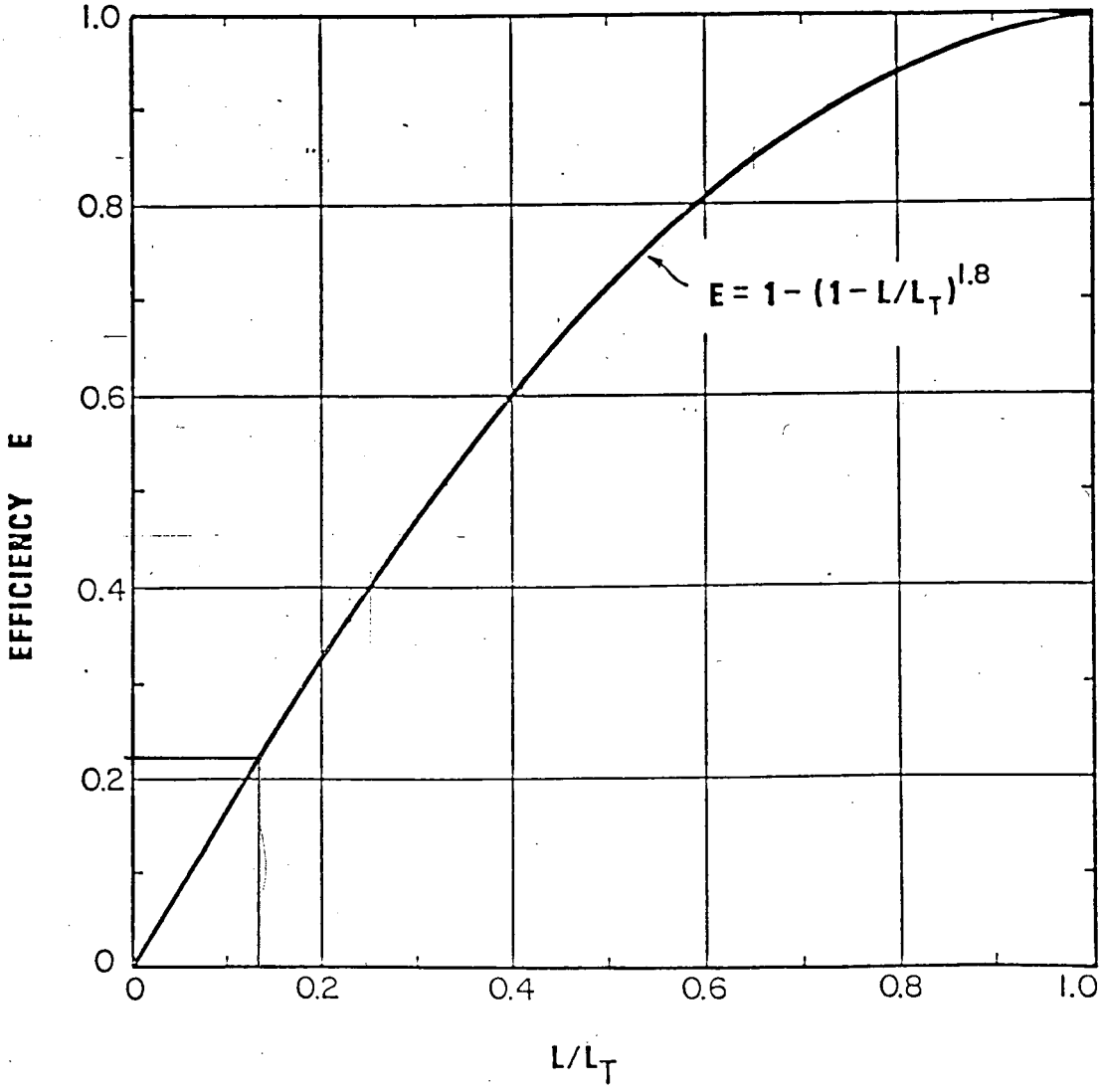


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA., MAY 1984

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The Qintercepts derived by flood routing were input into storm program. This will check if pipe sizes are controlling.

From Pages 9 & 10, HGL Elev. due to pipe is below the ponding elevations at Nodes 103 & 102.
∴ Inlets control HGL

SUMMARY

The proposed storm sewer system as shown, will handle a portion of the 5-yr runoff, assuming free outflow at Node 100. Existing storm water sewer system East of Node 100 was not analyzed.

Qintercept may vary, depending on Final Site Grading Plan of W 1/2 of Lot 1, Block A.

```
100 j,   82.8000  100    3    4    3
110 t,broadway 47 plaza 2nd addition
120 t,drainage plan
130 t,5-year storm analysis
140 i,  103    1.00    3.57    0.00    0.00    7.00   15.00   86.40
150 i,  102    1.00    1.94    0.00    0.00    4.50   15.00   86.00
160 i,  101    0.85    1.17    0.00    0.00    4.20   15.00   85.00
170 m,  100   86.00
180 p,  103  102   285.00  18 0.013  45.00    0.00
190 p,  102  101   200.00  24 0.013  50.00    0.00
200 p,  101  100   380.00  24 0.013   0.00    0.00
210 e
```

Date: 03-27-1987
Time: 09:18:08

Input File: brd47pl

broadway 47 plaza 2nd addition
drainage plan
5-year storm analysis

Storm Frequency = 5-Year

* * * H Y D R O L O G Y * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
103	102	1.00	3.57	0.00	0.0	15.00	5.22	7.00	15.00	5.22	7.00	7.00	18"	3.96	285.00	1.20	16.20
102	101	1.00	1.94	0.00	0.0	15.00	5.22	4.50	16.20	5.06	4.37	11.37	24"	3.62	200.00	0.92	17.12
101	100	0.85	1.17	0.00	0.0	15.00	5.22	4.20	17.12	4.95	3.99	15.36	24"	4.89	380.00	1.30	18.42

Date: 03-27-1987
Time: 09:18:08

Input File: brd47p1

broadway 47 plaza 2nd addition
drainage plan
5-year storm analysis

Storm Frequency = 5-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)
103	0.00444	1.2656	0.0000	0.0000	0.0000	0.0000	0.0000	1.2656	86.9907	86.4000	-0.59
102	0.00252	0.5049	0.0000	0.0081	0.0000	0.0530	0.1873	0.7534	85.7251	86.0000	0.27
101	0.00461	1.7509	0.0000	0.0168	0.0000	0.0502	0.3539	2.1717	84.9717	85.0000	0.03
100	0.00000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	82.8000	86.0000	3.20

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Project Broadway 47 Plaza 2nd Addition

Item Drainage Plan.

I HYDROLOGY (Rational Method)

Node	C	I_{100}	A	Q_{100}
103	1.0	7.37	3.57	26.3
102	1.0	7.37	1.94	14.3
101	0.95	7.37	4.40	30.8

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Date 3.27.87 Page 2 of 5

Project Broadway 47 Plaza 2nd Addition

Item Drainage Plan

II FLOOD ROUTING 100-YR STORM

Node 103

$Q_{approach}$ = 26.3 cfs

Q_{int} = 7.0 cfs (See 2yr calcs)

Q_{bypass} = 26.3 − 7.0 = 19.3 cfs to Node 103

Node 102

$Q_{approach}$ = 14.3 + 19.3 = 33.6 cfs

$Q_{intercept}$ = 4.5 cfs

Q_{bypass} = 33.6 − 4.5 = 29.1 cfs to Node 100

Node 101

$Q_{approach}$ = 30.8 cfs

L_T = 47

L = 5

L/L_T = 5/47 = 0.106

Efficiency = 19%

$Q_{intercept}$ = .19 × 30.8 = 5.9

Q_{bypass} = 30.8 − 5.9 = 29.9 to Node 100

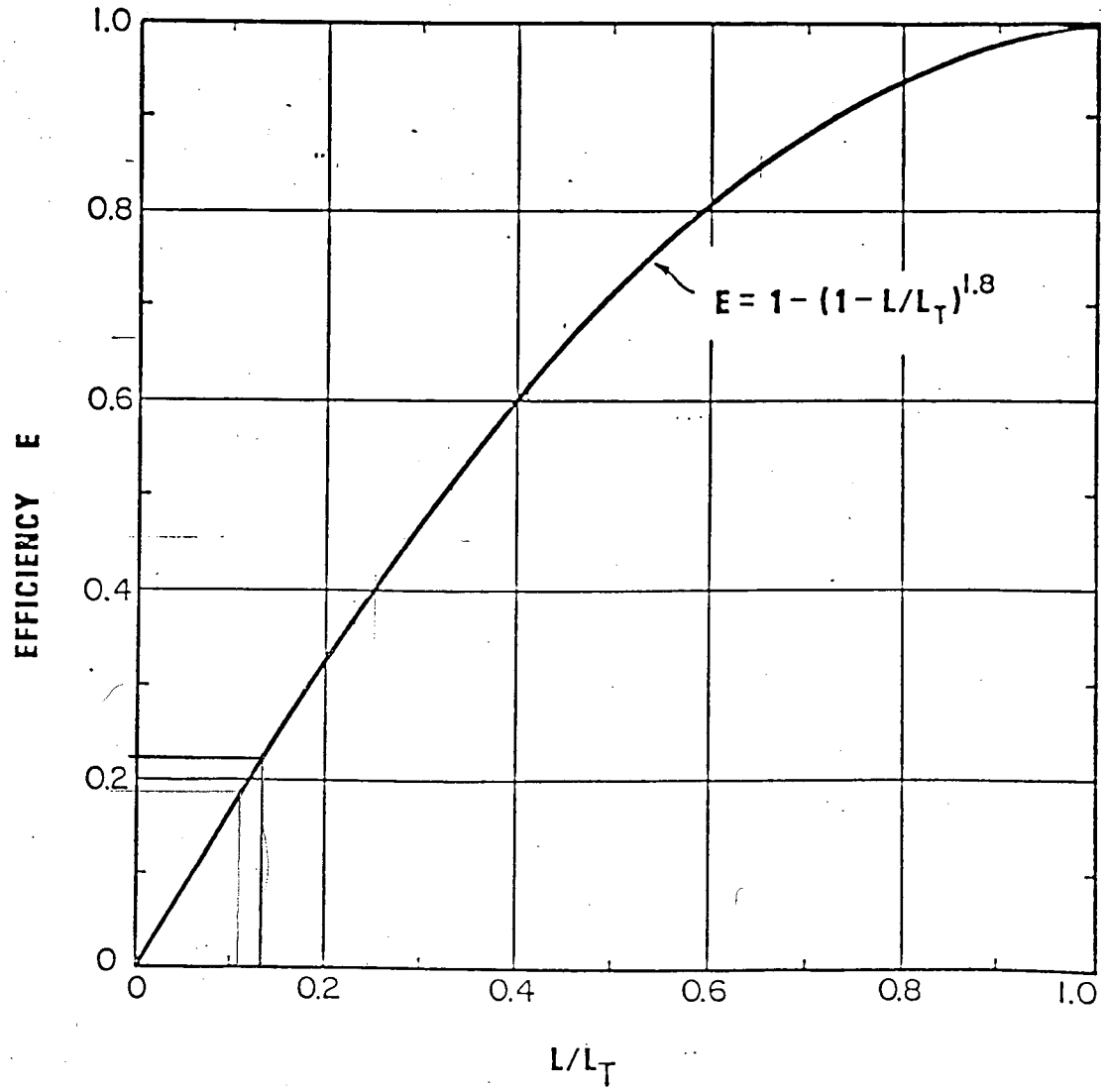


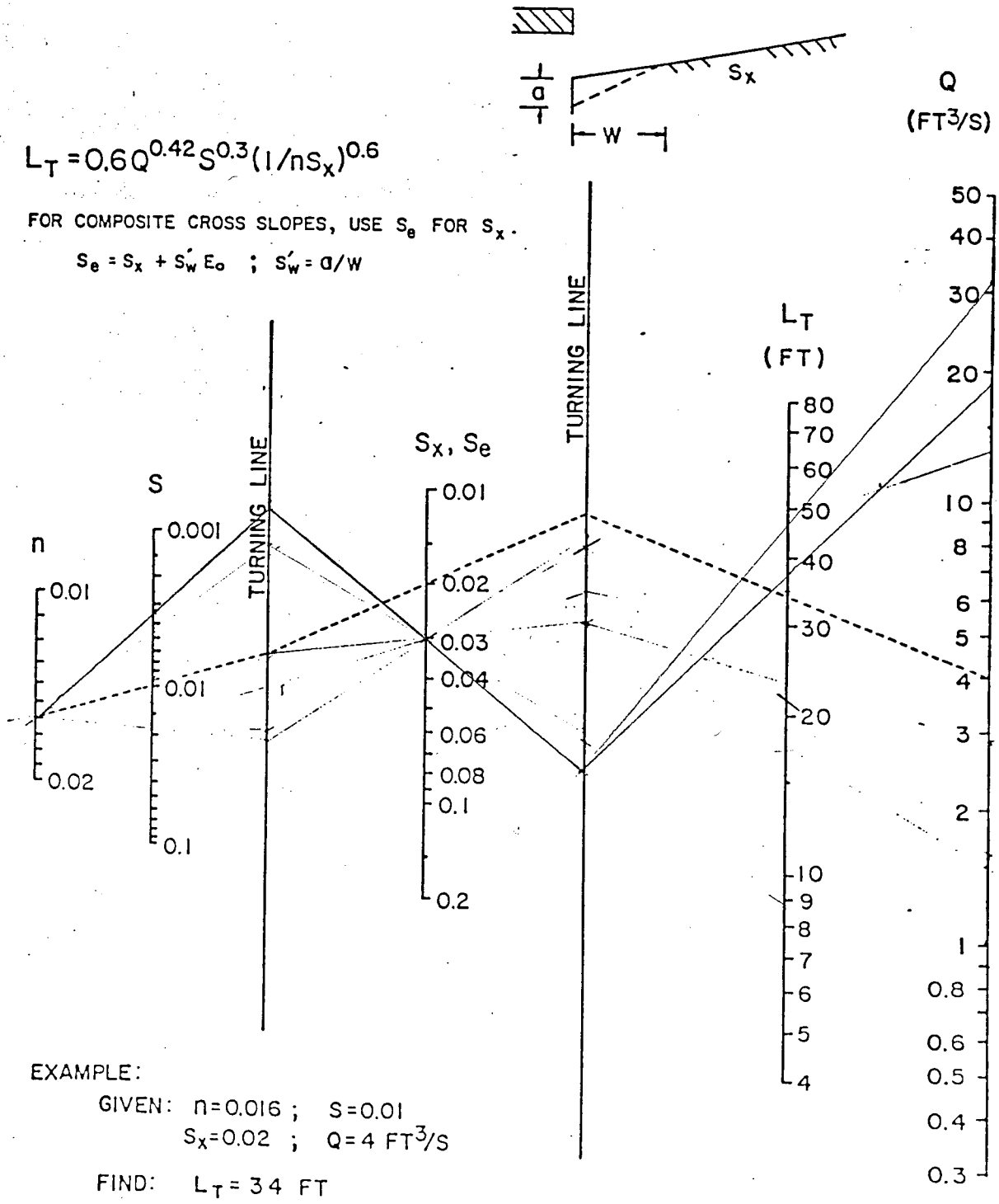
CHART 10. Curb-opening and slotted drain inlet interception efficiency.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAY 1984

$$L_T = 0.6 Q^{0.42} S^{0.3} (1/nS_x)^{0.6}$$

FOR COMPOSITE CROSS SLOPES, USE S_e FOR S_x.

$$S_e = S_x + S'_w E_o \quad ; \quad S'_w = a/W$$



EXAMPLE:

GIVEN: $n = 0.016$; $S = 0.01$
$S_x = 0.02$; $Q = 4\ FT^3/S$

FIND: $L_T = 34$ FT

CHART 9. Curb-opening and slotted drain inlet length for total interception.

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Project Broadway 47 Plaza 2nd Addition

Item Drainage Plan

SUMMARY

The storm sewer system to be extended into the West 1/2 of Lot 1 will accommodate a small portion of the 100-year storm. The amount of runoff which can be discharged via this storm sewer is limited due to downstream pipe sizes. The Final Grading Plan for the proposed development should be designed to maximize the amount of runoff which can be stored on the parking lot and thus minimize the amount of runoff entering the street.