PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

FOR

ROUNDS ESTATES

AN ADDITION TO WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

ENGINEERS

WICHITA, KANSAS

AUGUST 12, 1988

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PROFESSIONAL ENGINEERING CONSULTANTS
EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

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Project Rounds

Item 2-year bypass (east on Linden)

@ Node 105 Q_2 (n) = 3.9 cfs

Q_2 (s) = 1.0 cfs

construct 10' inlet on n. side intersection on grade.

Slope = 1.38%

From chart 9 (attached) L_T = 28'

w/ L = 10' L/L_T = 10/28 = 0.357

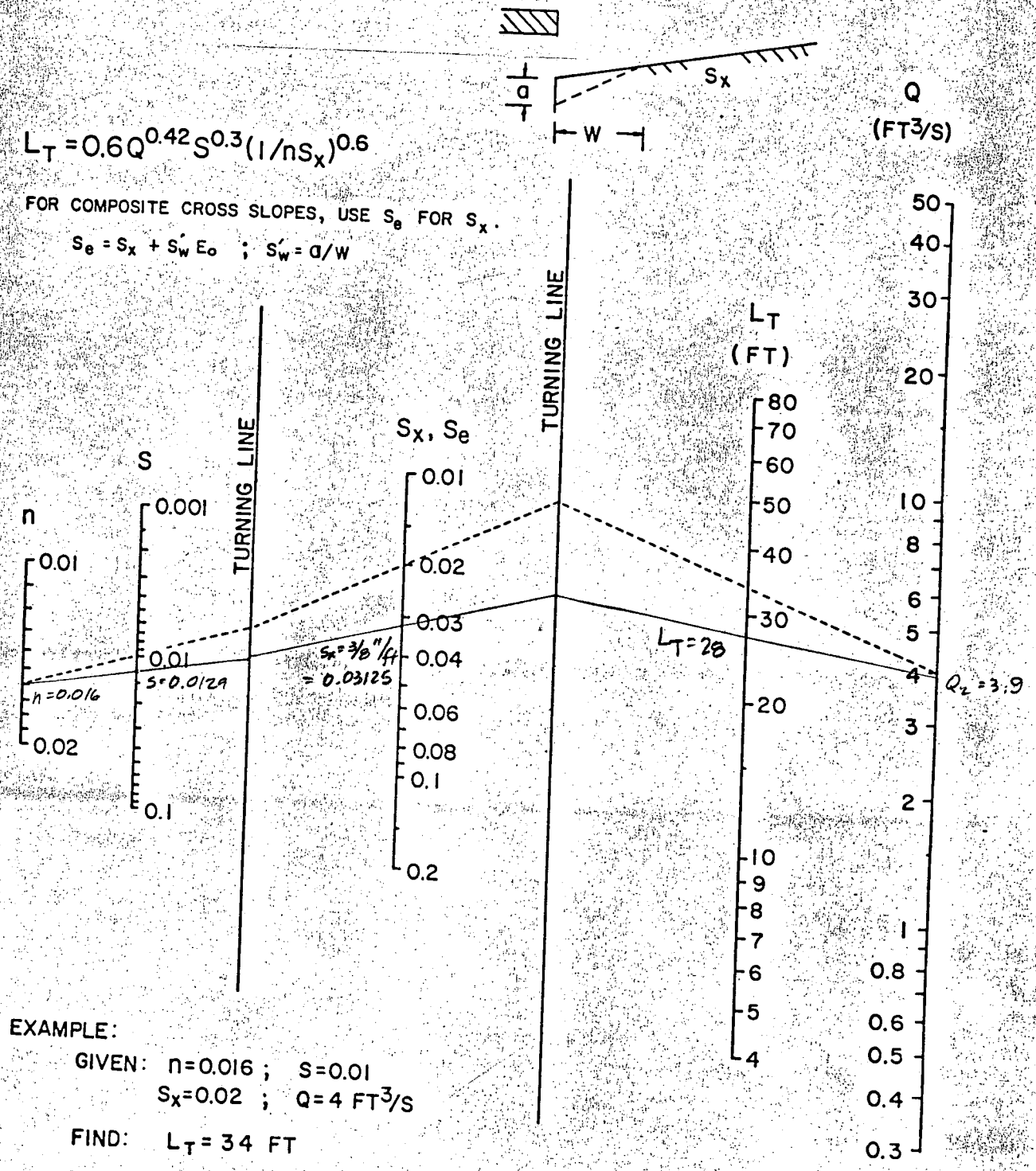
From chart 10 (attached) Efficiency = 0.55

$Q_{intercept}$ = 0.55 x 3.9 cfs = 2.1 cfs

$Q_{bypass\ (n)}$ = 3.9 - 2.1 = 1.8 cfs

Total Bypass (Flowing East on Linden) = 1.8 (north)
1.0 (south)
2.8 cfs.

2/6



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, F.H.W.A., MAR. 1969.

3/6

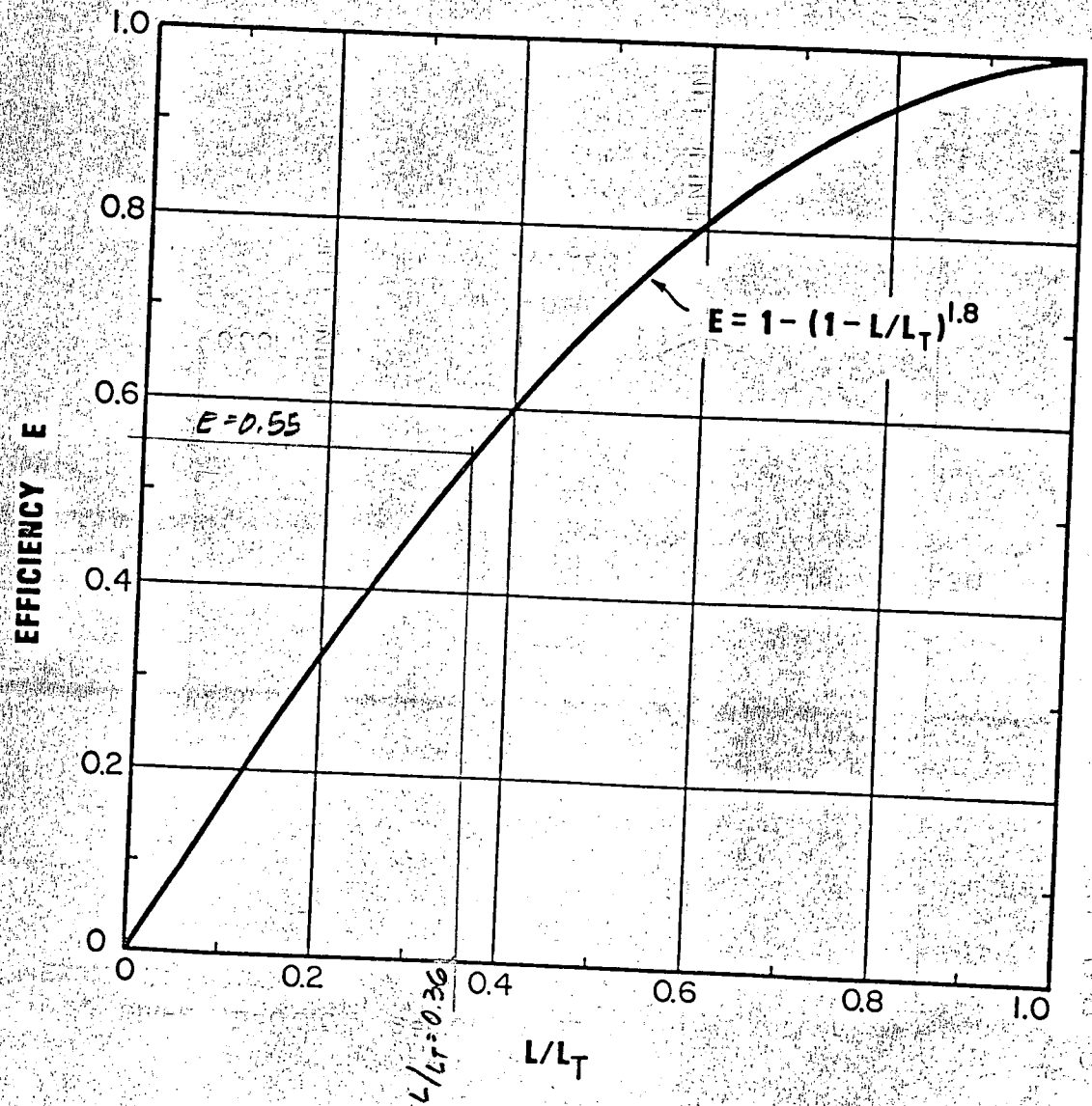


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR. 1984

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Project Rounds Estates

Item Drainage

Check Drainage in Gatewood St. adjacent to Rounds Estates.

Q_2 From MKEC's calcs; Autumn Chase

$Q_2 = C_2 I_2 A$

$= 0.87 \times 3.83 \times 2.86 = 9.5$ cfs

Assume 50% on each side of street

Q_2 adjacent to Rounds = $0.50 \times 9.5 = 4.8$ cfs

Add Q_2 overflow from Rounds = 2.8

Total Street Flow West side Gatewood St

= 7.6 cfs.

w/ std curb & 0.94% street grade,

depth of flow = 0.38' OK

Q_{100} From MKEC's calcs $Q_{100} = 19.2$ cfs

Add Overflow from Rounds $Q_{100} - Q_2 = 49.7 - 16.3 = 33.4$

(from PEC's Dr. Plan for Rounds)

Total Q_{100} in Gatewood = 33.4 + 19.2 = 52.6 cfs

Q_{max} on 35' B-B st. w/ std curb @ 0.94%

$= 882.3\ s^{1/2} = 85.5$ cfs

OK

Chart 1

EQUATION: $Q = 0.56\left(\frac{z}{n}\right) S^{\frac{1}{2}} d^{\frac{8}{3}}$

n IS ROUGHNESS COEFFICIENT IN MANNING FORMULA APPROPRIATE TO MATERIAL IN BOTTOM OF CHANNEL

z IS RECIPROCAL OF CROSS SLOPE

REFERENCE: H. R. B. PROCEEDINGS 1948, PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

GIVEN: $S = 0.03$

$z = 24$

$n = .02$ $\Big\}$ $z/n = 1200$

$Q = 2.0$ CFS

FIND: $d = 0.22$ BY FOLLOWING DASHED LINES

RATIO z/n

10000, 9000, 8000, 7000, 6000, 5000, 4000, 3000, 2000, 1000, 900, 800, 700, 600, 500, 400, 300, 200, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10

TURNING LINE

DISCHARGE (Q) IN CFS

100, 70, 50, 30, 20, 10, 7, 5, 3, 2, 1, .7, .5, .3, .2, .1, .07, .05, .03, .02, .01

SLOPE OF CHANNEL (S) IN FT./FT.

.10, .08, .07, .06, .05, .04, .03, .02, .01, .008, .007, .006, .005, .004, .003, .002, .001

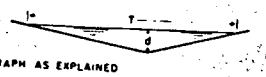
DEPTH AT CURB OR DEEPEST POINT (d) IN FT.

2.0, 1.0, .80, .70, .60, .50, .40, .30, .20, .10, .08, .07, .06, .05, .04, .03, .02, .01

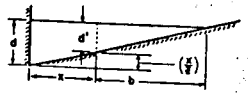
INSTRUCTIONS

1. CONNECT z/n RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH POINT WHERE LINE CROSSES TURNING LINE READ DEPTH AT CURB (d) Q CAN BE FOUND FROM d BY CONNECTING d WITH CROSSING OF TURNING LINE.

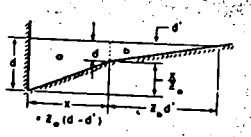
2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH AS EXPLAINED IN INSTRUCTION 1 BUT WITH $z = \frac{T}{d}$.



3. TO DETERMINE DISCHARGE Q_x IN PORTION OF CHANNEL HAVING WIDTH x: DETERMINE DEPTH d FOR TOTAL DISCHARGE IN ENTIRE SECTION AS EXPLAINED IN 1. THEN USE NOMOGRAPH TO DETERMINE Q_b IN SECTION OF WIDTH b FOR DEPTH $d' = d - \left(\frac{x}{z}\right)$. THEN $Q_x = Q - Q_b$.



4. TO DETERMINE DISCHARGE (Q_t) IN COMPOSITE SECTION:- FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE (Q_a) IN SECTION a AT ASSUMED DEPTH d BASED ON AN EXTENSION OF SLOPE RATIO z_a TO INTERSECT WATER SURFACE; OBTAIN Q_b FOR SLOPE RATIO z_b AND DEPTH d'; $d' = d - \frac{x}{z_a}$ THEN $Q_t = Q_a + Q_b$.



BUREAU OF PUBLIC ROADS
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NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

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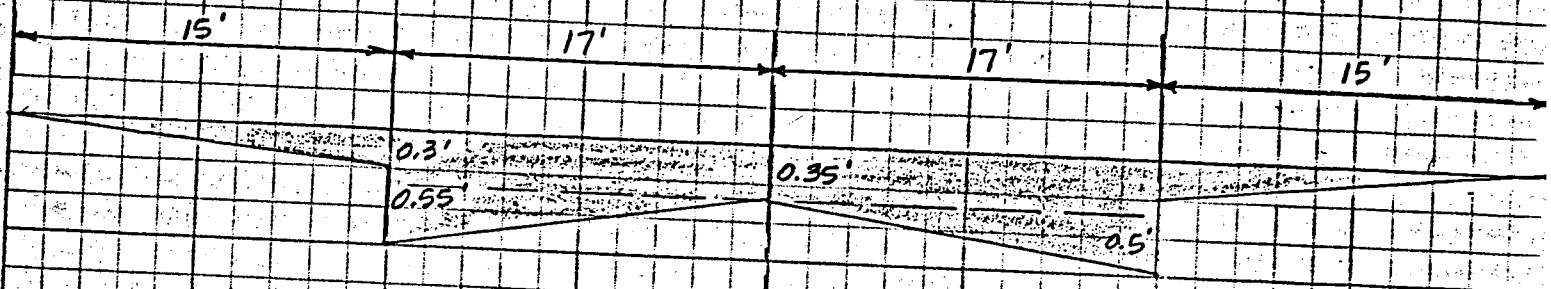
Project ____

Item Drainage

Check Street Flow 100-yr (Walk Grade +0.3')



Determine Q_{max} in Street R-O-W

Use Mannings Eq'n $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$$n = \frac{2(14.5 \times 0.030) + 2(1.05' \times 0.013) + 2(17 \times 0.016)}{65.1}$$

$n = 1.4413 / 65.1 = 0.0221$

$A = 2(1/2 \times 15 \times 0.3) + (34 \times 0.35) + 2(1/2 \times 0.5 \times 17)$

$= 24.90$ SF

$P = (2 \times 15) + (2 \times 17) + (2 \times 0.55)$

$= 65.1'$

$R = A/P = 24.9 / 65.1 = 0.38249$

$R^{2/3} = 0.527$

$Q = \frac{1.486}{0.0221} \times 24.90 \times 0.527 \times S^{1/2}$

$Q = 882.3 \times S^{1/2}$