Appraisal of Needs and Cost Estimating Procedures

Minnesota Trunk Highway Needs Study

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Minnesota's Trunk Highway Needs Study, which was started in 1961, is designed to utilize insofar as possible the speed and efficiency of electronic data processing equipment to compute, list, and summarize the cost of needed construction on the State Highway System. The computer procedures are programmed for the IBM 1410 computer and are so arranged that various parts of the basic input data may be revised periodically as changes occur in the factors which influence the end result of cost computations.

The results of this study and related computer programs have been very satisfactory. The updating features of the programs have been utilized and found to work as expected.

The output data are being used for construction programming, informational releases to the general public, and in conjunction with legislative inquiries and presentations.

•PERIODICALLY every state has made studies of its highway systems to determine their adequacy and the estimated costs involved in correcting deficient sections. The degree of accuracy has run from a rough appraisal based on general averages to fairly concise estimates based on quantities of work and realistic unit prices for the types of work involved. The states have seldom been able to keep the studies current because of varying cost increases of the various items, changes in design and construction standards, and revisions in traffic projections. These varying components require a multitude of computations to maintain such a study in current status. Without the use of modern electronic computers, the task of maintaining these studies would be a tedious and prohibitive process.

As in other states, Minnesota's highway systems have been the subject of needs studies in the past. Due to legislative action, the 30,000-mile County State-Aid Highway and 1,200-mile Municipal State-Aid Street Systems have had continuing needs studies since 1957. Work on the continuing Trunk Highway Needs Study was started in mid-1961 with the first six to nine months spent reviewing needs study procedures used previously in Minnesota and several other states, designing the data collection sheets, writing the manual of instructions, and having preliminary conferences with the programmer for the computer operations.

The Trunk Highway Needs Study computer procedures have been programmed for the IBM Model 1410 computer and related equipment. These procedures have been organized to utilize, wherever possible, the speed and efficiency of electronic data processing. The computer program is so arranged that the various phases may be revised periodically as changes occur in design criteria, traffic data, or cost factors without disrupting the balance of the basic information.

Paper sponsored by Committee on Highway Needs and presented at the 43rd Annual Meeting.

Form No. 2972
12-61
(Rev. 4-62)

MINNESOTA HIGHWAY DEPARTMENT - U.S. BUREAU OF PUBLIC ROADS
TRUNK HIGHWAY NEEDS STUDY - ROADWAY DATA SHEET

IDENTIFICATION

1. Control Section _____ 2. Segment _____ 3. District _____ 4. T.H. _____ 5. Length _____
6. Municipality _____ 7. Termini _____
8. Federal Designation: Interstate Rural (1) Urban (2) Primary Rural (3) Urban (4) Secondary Rural (5) Urban (6) Non-Federal Rural (7) Urban (8)
9. Urban Classification: Non-Municipal: Non-Urban (1) Urban (2) Municipal: Non-Urban (3) Urban (4)
10. Service Level of Facility: Freeway (1) Expressway (2) Trunk Route (3) Collector (4) For Office Use (5) (6)
11. Proposed Springtime Restriction: Plan "A" _____ Plan "B" _____ Final _____
12. Legal Designation: Constitutional Route (1) Legislative (2) Cost Range (1) (2) (3)

TRAFFIC DATA

13. Est. Present Traffic (Average Daily Traffic) _____ 14. Year _____
15. Est. Future Traffic (Average Daily Traffic) _____ 16. Year _____
17. Percent Commercial _____ 18. Commercial _____
19. Percent for 30th Peak Hr. _____ 20. 30th PH (_____) = 22. Vol./Cap Ratio _____
21. Practical Capacity (No Parking) ..... (_____)
23. Estimated Classification of Trucks:
(a) Percent 2 axle single _____ (b) Percent 3 axle single _____
(c) Percent 3 axle TT-ST _____ (d) Percent 4 axle TT-ST _____
(e) Percent 5 axle TT-ST _____
(f) Total Percent (b) + (d) + (e) = _____

ROAD DATA (Existing or under Contract)

I. Thru Roadway:

24. Left Roadway (Or Non-Divided Facility)

	Type	Thickness	Width
A. Surface		B.	C.
D. Shoulder		E.	
F. Base		G.	

H. Latest Grading Year _____
I. Latest Surfacing Year _____

25. Right Roadway (Divided Highway Only)

	Type	Thickness	Width
A. Surface		B.	C.
D. Shoulder		E.	
F. Base		G.	

H. Latest Grading Year _____
I. Latest Surfacing Year _____

26. Design Speed MPH _____ 27. No. of Traffic Lanes (2) (3) (4) (6) 28. Not Divided (1) Divided (2)
29. Median: None (0) Raised (1) Depressed (2) 30. Median Width (Ft.) _____
31. Percent of Passing Sight Distance Less Than 1500 Ft. _____ 32. Geometric Design: Rural (1) Urban (2)
33. Maintenance Rating: Non-Excessive (1) Excessive (2)
34. Terrain: Swampy (1) Flat (2) Rolling (3) Rugged (4)
35. Construction Status: Not Under Construction (0) Surface Remaining (1) Base & Surface Remaining (2) Complete Construction (3)
36. Present Springtime Load Capacity (Tons). (3) (4) (5) (6) (7) (8) (9)
37. No. of Bridges (Report on Form #2973) _____ 38. No. of R.R. X-ings (Report on Form #2974) _____

II. Interchanges (Ramps Only)

	Type	Thickness	Width
39. Surface		40.	41.
42. Shoulder		43.	
44. Base		45.	

46. Total Length (Miles) _____
47. Year of Construction _____

III. Frontage Roads:

48. Left Side Length (Miles) _____

	Type	Thickness	Width
A. Surface		B.	C.
D. Shoulder		E.	
F. Base		G.	

H. Year of Construction _____

49. Right Side Length (Miles) _____

	Type	Thickness	Width
A. Surface		B.	C.
D. Shoulder		E.	
F. Base		G.	

H. Year of Construction _____

IV. Climbing Lanes:

	Type	Thickness	Width	Length (Feet)
50. Surface:		51.	52.	53.
54. Base		55.	56. Year of Construction	

Figure 1.

V. Urban Information:

57. Right of Way Width _____ Ft. 58. Building Line to Building Line Width _____

59. Parking: None (0) Off Peak Only: One Side (1) Both Sides (2) Center (3)
Continuous: One Side (4) Both Sides (5) Center (6)

60. Traffic Flow: One Way (1) Two Way (2)

61. Curbs: None (0) One Side (1) Both Sides (2) 62. Boulevard Width _____

63. Sidewalks: None (0) One Side (1) Both Sides (2) 64. Sidewalk Width _____

65. Illumination: None (0) Intersections Only (1) Continuous (2)

66. Access Control: None (0) Partial (1) Full (2)

67. Type of Drainage (Describe) _____

68. Type of Area: Residential % _____ Commercial % _____ Industrial % _____

VI. Condition Ratings & Recommended Construction Period:

69. Conformance to Minimum Standards:

A. Presently Adequate (1) Presently Deficient (2)

B. Future Deficiency: 1-5 Yrs. (1) 6-10 Yrs. (2) 11-15 Yrs. (3) 16-20 Yrs. (4) None (0)

C. Features Deficient: None (0) Geometric (1) Structure (2) Other (3) Combination (4)

70. Recommended Construction Period:

First 5-Yr. Period (1) Second 5-Yr. Period (2) Third 5-Yr. Period (3) After Third 5-Yr. Period (4)

71. Rating Factors:

A. Foundation _____ B. Surface _____ C. Load Carrying Capacity _____ D. Safety _____

E. Traffic Capacity _____ F. Total Rating _____ G. Adjusted Rating _____

72. Hazard Conditions:

A. No. of Stopping Sight Distance Restrictions _____ B. No. of Deficient Horizontal Curves _____

C. No. of Narrow Bridges _____ D. No. of Intersections at Grade _____

ROAD DATA PROPOSED

73. Estimated Length _____ Mi. 74. Proposed Width _____ Ft.

75. Alignment: Same (1) New (2) 76. Not Divided (1) Divided (2)

77. Traffic Lanes: (2) (4) (6) Other _____ 78. Design Load (Tons) (7-9) (9)

79. Terrain (New Alignment): Swampy (1) Flat (2) Rolling (3) Rugged (4)

80. Predominant Soil Class of Proposed Subgrade:

A3 (50%) (1) A2 (75%) (2) A6 (100%) (3) A7 (125%) (4)

81. Surface Type: Rigid (1) Flexible (2) 82. Design: Rural (1) Urban (2)

83. Number of Traffic Separations Required: (Report on Form #2973) _____

84. Ramp Lengths (Total _____ Mi.) 85. Climbing Lanes (Total _____ Ft.)

86. Frontage Roads (Total _____ Mi.) 87. Frontage Road Load Design (Tons) (5) (7) (9)

88. Number of Cross Roads Affected (Report on Form #2975) _____

89. Utility Adjustments: Not Required (1) Required (2)

RIGHT OF WAY NEEDS (Estimated Cost - Item 91 Will Be Provided By R/W Section)

90. R/W Not Needed (1) R/W Needed* (2)

91. Estimated Cost _____ (Thousands of Dollars)
* If R/W is Needed, Complete Separate Form #2976.

CONSTRUCTION ITEMS

I. Grading

92. Clearing & Grubbing: None (0) Light (1) Average (2) Heavy (3)

93. Demolition: None (0) Industrial (1) Urban (2) Suburban (3) Rural (4)

94. Removal Items: Concrete Pavement (S. Y.) _____ Concrete or Masonry Structures (C. Y.) _____
Portable Culverts (L. F.) _____ Curb & Gutter (L. F.) _____ Sidewalk (S. F.) _____

95. Type of Grading: None (0) Reshape Only (Minor) (1) Widen Only (No Grade Change) (2)
Regrade & Widen (3) Regrade (Complete) (4) Complete (New Alignment) (5)

96. Class of Excavation: (C. Y. Per Mile):
Class "A" _____ Class "B" _____ Class "A" Borrow _____ Class "B" Borrow _____

97. Swamp Excavation: Estimate Total C. Y. _____

98. Swamp Backfill: Estimate Total C. Y. Adjacent Cuts _____ Borrow _____

99. Rock Excavation: Estimate Total C. Y.:
Class "ASR" _____ Class "ALR" _____ Class "AIR" _____

100. Minor Drainage Structures: Number Under 10 Feet _____
Number 10-20 Feet _____

Figure 1. Continued.

II. Base

101. Left Roadway: (Or Non-Divided Facility)

				Partial Base Only
None	(0)	Gravel	(1)	T/M
Complete Base	(1)	Bituminous	(2)	T/M
Widening	(2)	Soil Cement	(3) Inches	SY/M
Strengthening	(3)	Slip Form Concrete	(4) Inches	SY/M
		Formed Concrete	(5) Inches	SY/M

102. Right Roadway: (Divided Highway Only)

				Partial Base Only
None	(0)	Gravel	(1)	T/M
Complete Base	(1)	Bituminous	(2)	T/M
Widening	(2)	Soil Cement	(3) Inches	SY/M
Strengthening	(3)	Slip Form Concrete	(4) Inches	SY/M
		Formed Concrete	(5) Inches	SY/M

III. Surfacing

103. Left Roadway: (Or Non-Divided Facility)

None (0)
Additional Bituminous (1) Inches _____ T/M _____ 2321 (2) 2331 (3) 2341 (4) 2351 (5)
Complete Bituminous (2)
Slip Form Concrete (3) Inches _____ SY/M _____ Non-Reinforced (1) Reinforced (2)
Formed Concrete (4) Inches _____

104. Right Roadway: (Divided Highway Only)

None (0)
Additional Bituminous (1) Inches _____ T/M _____ 2321 (2) 2331 (3) 2341 (4) 2351 (5)
Complete Bituminous (2)
Slip Form Concrete (3) Inches _____ SY/M _____ Non-Reinforced (1) Reinforced (2)
Formed Concrete (4) Inches _____

IV. Shouldering:

105. None (0) Complete Shoulder (1)
Reshouldering (2) Quantity T/M _____

V. Miscellaneous Items: (Do Not Include Items To Be Done By Maintenance Forces)

106. Fencing (Hundredths of Miles): Rural _____ Urban _____

107. Storm or Sanitary Sewers (L. F.) _____ Approximate Size (Inches) _____

108. No. of Lighting Installations: Partial (Interchanges or Intersections Only) _____
Continuous (Maybe a Portion of the Segment) _____

109. No. of Traffic Signal Installations: Flashing Beacons _____ Isolated Pretimed _____
Interconnected Pretimed _____ Full Traffic Actuated or Pedestrian Signals _____
Traffic Adjusted (3 to 5 Intersections) _____ Traffic Adjusted (5 or More Intersections) _____

110. Signing: No (1) Yes (2) 111. Curb (L. F.) _____ 112. Curb & Gutter (L. F.) _____

113. Sidewalk (S. F.) _____ 114. Guard Rail: Double Cable (L. F.) _____ Structural Plate (L. F.) _____

115. Roadside Development: (Estimated Cost) _____

116. Other (Specify) _____

REMARKS

Figure 1. Continued.

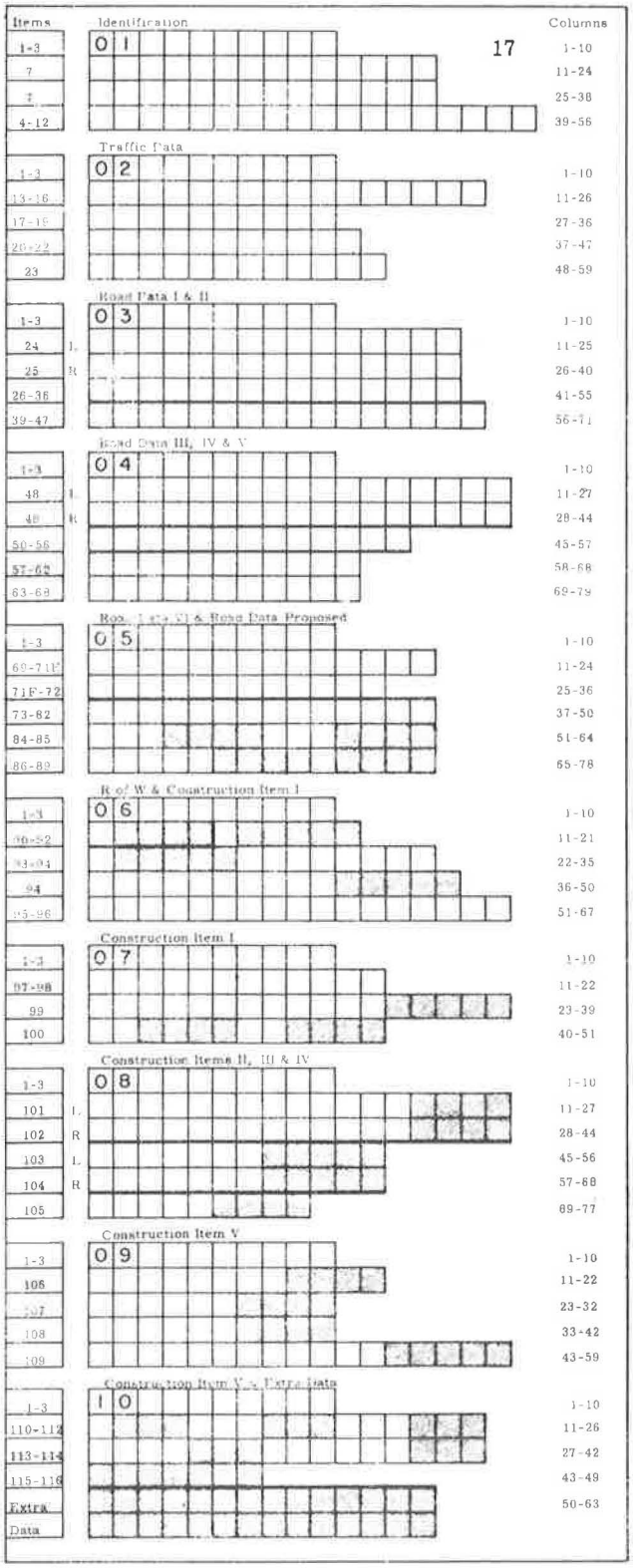


Figure 1. Continued.

Form No. 2973
1-62

MINNESOTA HIGHWAY DEPARTMENT - U.S. BUREAU OF PUBLIC ROADS
TRUNK HIGHWAY NEEDS STUDY - STRUCTURE DATA SHEET

IDENTIFICATION

1. Control Section _____ 2. Segment _____ 3. District _____
4. Located on T.H. _____ , _____ Miles _____ of _____
5. M.H.D. Bridge No. _____ 6. Bridge Sequence No. _____

EXISTING CONDITIONS (Or Under Contract)

7. Type of Service: Stream X-ing (1) Hwy./R.R. (2) R.R./Hwy. (3)
Highway Separation (4) Highway Interchange (5)
R.R. Grade X-ing (6) Local Road Crossing At Grade (7)
8. Type of Structure _____ 9. Year Built _____
10. Structure Length _____ Ft. 11. No. of Spans _____
12. Roadway Width _____ Ft. 13. Sidewalk Width: Left _____ Right _____
14. Vertical Clearance _____ (To Tenths) 15. Safe Loading _____ Tons
16. Substructure: Steel (1) Concrete or Masonry (2) Timber (3) Other (4)
17. Superstructure: Steel (1) Concrete or Masonry (2) Timber (3) Other (4)
18. Type of Floor: Steel (1) Concrete (2) Wood (3) Other (4)
19. Placement: Skew (1) Square (2) 20. Projected A.D.T. _____

ADEQUACY & RECOMMENDED CONSTRUCTION PERIOD

21. Conformance To Minimum Standards
A. Presently Adequate (1) Presently Deficient (2)
B. Future Deficiency:
1-5 Yrs. (1) 6-10 Yrs. (2) 11-15 Yrs. (3) 16-20 Yrs. (4) None (0)
C. Features Deficient: None (0) Capacity (1) Structure (2) Other (3)
22. Recommended Construction Period
1st 5-Yrs. (1) 2nd 5-Yrs. (2) 3rd 5-Yrs. (3) After 3rd 5-Yrs. (4)

PROPOSED IMPROVEMENT

23. Type of Service: Stream X-ing (1) Hwy./R.R. (2)
R.R./Hwy. (3) Hwy./Hwy. (4)
24. Type of Work: Redeck (1) Recondition (2) Replace - Same Site (3)
Replace - New Site (4) New Structure (5)
25. Type of Structure _____ 26. Structure Length _____
27. Design Load: H15-S12 (1) H20-S16 (2) Other (3) _____
28. Roadway Width _____ 29. Sidewalk Width: Left _____ Right _____
30. Substructure Material:
Steel (1) Concrete (2) Tr. Timber (3) Other (4) _____
31. Superstructure Material:
Steel (1) Concrete (2) Tr. Timber (3) Other (4) _____

COST ESTIMATE (Thousands of Dollars)

32. Right of Way (See Instructions) $ _____
33. Approaches (See Instructions) $ _____
34. Structure Cost $ _____
35. Total Cost $ _____

Items	Columns
Card 1	1 - 2
1	3 - 6
2	7 - 9
3	10
4	11 - 13
4	14 - 17
4	18 - 24
5	25 - 29
6	30 - 32
7	33 - 35
8	36 - 42
8	43 - 49
9	50 - 51
10	52 - 55
11	56 - 57
12	58 - 60
13	61 - 64
14	65 - 67
15	68 - 69
16-19	70 - 76
Card 2	1 - 2
1	3 - 6
2	7 - 9
3	10
21	11 - 13
22	14
23	15
24	16
25	17 - 23
25	24 - 30
26	31 - 34
27	35
28	36 - 38
29	39 - 42
30	43
31	44
32	45 - 48
33	49 - 52
34	53 - 56
35	57 - 63
Extra	64 - 70

DESCRIPTION OF IMPROVEMENT & REMARKS: _____

Figure 2.

Form No. 2974
1-62

MINNESOTA HIGHWAY DEPARTMENT - U.S. BUREAU OF PUBLIC ROADS
TRUNK HIGHWAY NEEDS STUDY - RAILROAD CROSSING DATA SHEET

IDENTIFICATION

1. Control Section _____ 2. Segment _____ 3. District _____
4. Name of Railroad _____ 5. X-ing No. _____
6. Location: Section _____ Township _____ Range _____
7. Located _____ Miles (E) (W) (N) (S) Of Depot At _____

EXISTING CONDITIONS

8. No. of Tracks: Mainline _____ Passing _____ Other _____
9. Daily Train Movements: Scheduled _____ Irregular _____
10. Approximate Speed _____ 11. Alignment: Tangent (1) Curve (2)
12. No. of Accidents (1930 To Present) _____ Injured _____ Killed _____
13. Type of Protection: None (0) Signs Only (1)
Signals Only (2) Signals & Gates (3)
14. Presently Adequate (1) Presently Deficient (2)

Sketch of Location

Indicate North Arrow in Box

T. H. _____

Proj. A. D. T. _____

Note: Distances and grade shown are from Intersection of Road and R. R.

15. Clear Vision at 300 Feet (All Quadrants) Yes (1) No (2)

PROPOSED IMPROVEMENTS

16. Proposed Protection: None (0) Signs Only (1) Signals Only (2)
Signals & Gates (3) Separation (4)

Describe: _____

NOTE: If a Separation is Proposed, Complete Form #2973

17. Recommended Construction Period:
1-5 Yrs. (1) 6-10 (2) 11-15 (3) 16-20 (4) None (0)

COST ESTIMATE

18. Proposed Protection Estimated Cost $ _____

Items	Identification	Columns
Card	1 3	1 - 2
1		3 - 6
2		7 - 9
3		10
4		11 - 17
5		18 - 21
6		22 - 23
6		24 - 26
6		27 - 28
7		29 - 32
7		33
7		34 - 40
	Existing Conditions	
8		41 - 44
9		45 - 48
10		49 - 50
11		51
12		52 - 57
13		58
14		59
15		60
	Proposed Improvements	
16		61
17		62
	Cost Estimate	
18		63 - 68
	Extra Data	
Extra Data		

REMARKS: _____

Figure 3.

Form No. 2975
2-62

MINNESOTA HIGHWAY DEPARTMENT - U.S. BUREAU OF PUBLIC ROADS
TRUNK HIGHWAY NEEDS STUDY - LOCAL ROAD CROSSING DATA SHEET

IDENTIFICATION

1. Control Section _____ 2. Segment _____ 3. District _____
4. Name of Crossroad or Street _____ 5. X-ing No. _____
6. Located on T. H. _____ , _____ Miles _____ of _____

EXISTING CONDITIONS

7. Local Road Crossing Effected Length (Miles) _____

	Type	Thickness	Width
A. Surface	_____	B. _____	C. _____
D. Shoulder	_____	.....	E. _____
F. Base	_____	G. _____	.....

H. Latest Grading Year _____ I. Latest Surfacing Year _____

8. No. of Traffic Lanes _____ 9. No. of Parking Lanes _____
10. Divided (1) Not Divided (2) 11. Design Speed MPH _____
12. Present Crossroad Traffic (A. D. T.) _____ 13. Year _____
14. Projected Crossroad Traffic (A. D. T.) _____ 15. Year _____
16. Projected T. H. Traffic (A. D. T.) _____ 17. Year _____

PROPOSED CONSTRUCTION

18. Local Road Crossing Proposed Length (Miles) _____

	Type	Thickness	Width
A. Surface	_____	B. _____	C. _____
D. Shoulder	_____	.....	E. _____
F. Base	_____	G. _____	.....

CONSTRUCTION ITEMS

	UNIT COST	COST
19. Right of Way (Complete Form #2976)		$
20. Grading		
_____ CY. Class: (A) (B) Borrow: (Yes) (No)		
_____ CY. Swamp Excavation		
_____ CY. Swamp Backfill: Borrow (1) Cuts (2)		
_____ CY. Rock Class: (ASR) (ALR) (AIR)		
21. Base		$
_____ T/M Gravel		
_____ T/M Bituminous		
_____ SY/M _____ Inches _____ (Concrete Design)		
22. Surface		$
_____ T/M Bituminous		
_____ SY/M _____ Inches _____ (Concrete Design)		
23. Shoulders		$
_____ T/M Gravel		
_____ T/M Bituminous		
24. Utilities		$
Total of Items 20, 21, 22 & 23 _____ X ___ Percent		$
25. Total Cost Estimate		$

Remarks: _____

Items Card	Identification	Columns
1	1 4	1 - 2
1		3 - 6
2		7 - 9
3		10
4		11 - 17
5		18 - 20
6		21 - 23
6		24 - 27
6		28
6		29 - 35
	Existing Conditions	
7		36 - 39
A-C		40 - 44
D-E		45 - 47
F-G		48 - 50
H-I		51 - 54
8-11		55 - 59
12-13		60 - 66
14-15		67 - 73
Extra		74 - 80
	Proposed Construction	
1	1 5	1 - 2
1		3 - 6
2		7 - 9
3		10
18		11 - 14
A-C		15 - 19
D-E		20 - 22
F-G		23 - 25
H		26 - 29
	Cost Estimate	
19		30 - 33
20		34 - 37
21		38 - 41
22		42 - 45
23		46 - 49
24		50 - 53
25		54 - 57
	Extra Data	
Extra		58 - 64
Data		65 - 71
		72 - 78

Figure 4.

Form No. 2976
11-61

(Front)

TRUNK HIGHWAY NEEDS STUDY - HIGHWAY NEEDS UNIT
RIGHT-OF-WAY COST DETERMINATION

Control Section _____ Segment _____

T. H. No. _____ Segment Length _____ Mi.

Termini: _____

Location From Present Route (Describe or Use Space for Sketch on Back) ___

_____

_____

1. New Location ☐ Single Roadways ☐ 4 Lane Divided ☐

   Access Control Full ☐ Partial ☐ None ☐

   Length _____ Mi. $ _____

2. Old Location

   Additional Width _____ ft.

   Taking on Both Sides ☐ or _____ Side Only

Access Control Required: Full ☐ Partial ☐ None ☐

Access Previously Taken: Full ☐ Partial ☐ None ☐

   Length _____ Mi. $ _____

3. Additional R/W at Interchanges

Type	Location	
_____	_____	$ _____
_____	_____	$ _____
_____	_____	$ _____
_____	_____	$ _____

Total Items 1 and 2 $ _____

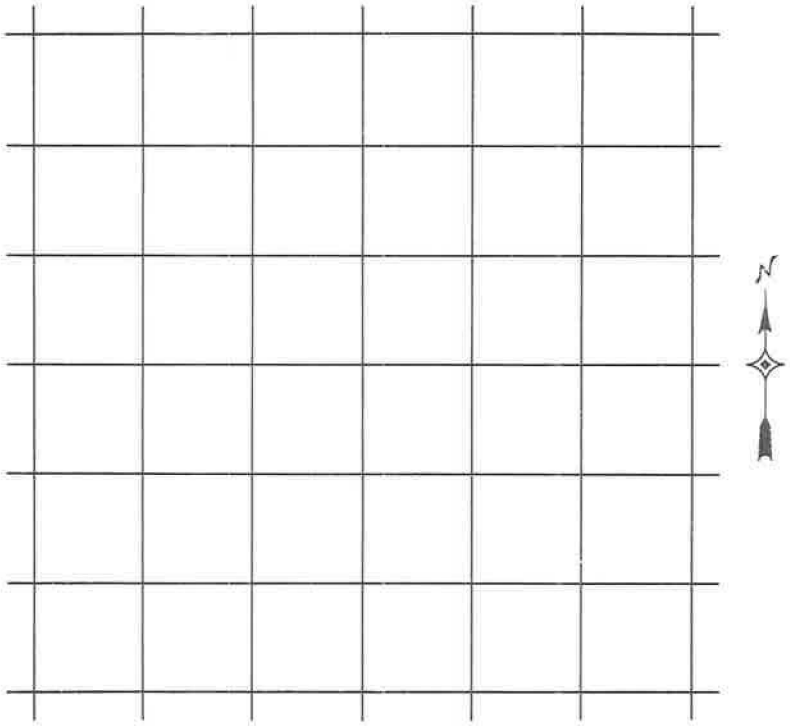
Total Item 3 $ _____

(Back)

Sketch of Location of Proposed Improvement
Scale

1" = approx. _____ Feet / Mile

(Strike out unit not applicable)



INSTRUCTIONS

1) Enter approximate distance scale used in space provided.
2) New Alignment - show approximate general location in relation to existing highway (s), county roads, towns, etc.
3) Existing Alignment - indicate locations and which side of present highway additional R/W should be acquired.
4) This sketch may be used to indicate location of R/W Needs on adjacent segments providing the affected segments are so noted on the sketch and sheets for affected segments are attached.

Figure 5.

TABLE 1

MINIMUM CONDITIONS CONSIDERED ADEQUATE FOR EXISTING TRAFFIC ON RURAL TRUNK HIGHWAYS

SERVICE LEVEL OF FACILITY		FREEWAY EXPRESSWAY	TRUNK ROUTES		FEEDER OR COLLECTOR ROUTES	
1960 ADT (DAILY HEAVY COMMERCIAL)		OVER 5,000 (OVER 600)	2,000-5,000 (300-600)	1,000-2,000 (150-300)	400-1,000	UNDER 400 (UNDER 150)
OPERATING SPEED, M.P.H.		50-55	45-50	40-45	AVERAGE 40	AVERAGE 40
SURFACE TYPE[4]		HIGH	HIGH INTERMEDIATE	LOW INTERMEDIATE	LOW	LOW
NUMBER OF LANES		4	2[1]	2	2	2
LANE WIDTH, FEET		12	12	11	10	10
SHOULDER WIDTH, FEET		8	6	6	4	3
MAXIMUM GRADIENT, PERCENT[2]		5-7	5-7	5-7	7-10	8-12
MAXIMUM CURVATURE, DEGREES[2]		5-9	6-14	6-14	9-14	11-25
STOPPING SIGHT DISTANCE		600	475	475	350	350
POSTED SPRINGTIME AXLE LOAD TONS		9	9	9	7 ULTIMATE 9 TON[3]	7 ULTIMATE 9 TON[3]
BRIDGES	SAFE LOADING	H 20	H 15	H 15	H 10	H 10
	WIDTH	MINIMUM PAVEMENT WIDTH + 2 FEET				MINIMUM SURFACE WIDTH
	VERTICAL CLEARANCE	14 FEET				
RAILROAD PROTECTION		GRADE SEPARATION	ALL CROSSINGS OF MAIN LINE TRACKS TO HAVE FLASHING LIGHTS. ALL OTHER CROSSINGS TO HAVE FLASHING LIGHTS WHEN EXISTING AVERAGE DAILY TRAFFIC X TRAINS PER DAY = 3,500.			

1. FOUR LANE DIVIDED WHEN OVER 8,000 AVERAGE DAILY TRAFFIC.
2. LOWER FIGURE FOR FLAT TERRAIN, HIGHER FIGURE FOR RUGGED OR HILLY TERRAIN.
3. UNLESS NECESSARY TO PROVIDE UNRESTRICTED OUTLET TO MUNICIPALITY OVER 1,000 POPULATION.
4. GOOD SURFACE CONDITION REQUIRED.

TABLE 2

MINIMUM CONDITIONS CONSIDERED ADEQUATE FOR EXISTING TRAFFIC ON URBAN TRUNK HIGHWAYS

SERVICE LEVEL OF FACILITY		FREEWAY	EXPRESSWAY	TRUNK ROUTES	TRUNK ROUTES	FEEDER OR COLLECTOR ROUTES
1960 ADT		OVER 25,000	10,000 - 30,000	3,000-10,000	1,000-3,000	UNDER 1,000
DESIGN SPEED, M.P.H.		50	35	30	30	30
DESIGN AXLE LOAD, TONS		9	9	9	9	9
SURFACE TYPE[1]		HIGH	HIGH	HIGH	INTERMEDIATE	
NUMBER OF LANES[2]		MINIMUM 4 DIVIDED	4 OCCASIONALLY DIVIDED	2 - 4	2	2
LANE WIDTH, FEET		11 PREFERABLY 12	11	10 - 10.5	10	10
ILLUMINATION		PREFERABLY CONTINUOUS	CONTINUOUS IN HIGHLY DEVELOPED AREAS	INTERSECTIONS		
PARKING		NONE	OCCASIONALLY	OCCASIONALLY RESTRICTED	NORMALLY PERMITTED	
CONTROL OF ACCESS		FULL	PARTIAL	OCCASIONALLY CONTROLLED	USUALLY NONE	
MINOR CROSS STREETS		TERMINATED	USUALLY TERMINATED	AT GRADE		
MAJOR CROSS STREETS		SEPARATED	OCCASIONALLY SEPARATED	NORMALLY AT GRADE		
CONTROL OF CROSS OR TURNING TRAFFIC AT GRADE		ALL SEPARATED	SIGNALS OR STOP SIGNS	SIGNALS OR STOP SIGNS		
PRIVATE DRIVEWAYS		NONE	CONTROLLED	SOME CONTROLLED	YES	YES
BRIDGES	WIDTH	PAVEMENT 4'	WIDTH OF THROUGH LANES			
	LOADING	H-20		H-15		
	VERTICAL CLEARANCE	14 FEET				
RAILROAD PROTECTION		ALL SEPARATED	ELIMINATE WHERE POSSIBLE FOR 2 OR MORE TRACKS OR FOR ONE TRACK WITH 6 OR MORE TRAINS. AUTOMATIC SIGNALS ON ALL OTHERS.		AUTOMATIC SIGNALS	

1. GOOD SURFACE AND CONDITION REQUIRED.
2. NUMBER OF THROUGH TRAFFIC LANES.

TABLE 3

NEW CONSTRUCTION DESIGN STANDARDS FOR RURAL TRUNK HIGHWAYS

SERVICE LEVEL OF FACILITY		INTERSTATE & FREEWAYS	EXPRESSWAYS	TRUNK ROUTES		FEEDER OR COLLECTOR ROUTES		
1981 ADT (DAILY HEAVY COMMERCIAL)		OVER 10,000 (OVER 1,100)	5000-10,000 (600-1,100)	2,000-5,000 (300-600)	1,000-2,000 (150-300)	400-1,000 (LESS	200-400 THAN 150)	UNDER 200
DESIGN SPEED, M. P. H.		70	70	70	70	60	50	50
OPERATING SPEED, M.P.H.		POSTED LIMIT	POSTED LIMIT	40-60[1]	40-60[1]	AVG. 45[1]	AVG. 45[1]	AVG. 45[1]
SURFACE TYPE		HIGH	HIGH	HIGH	HIGH INTERMEDIATE	LOW INTERMEDIATE	LOW	LOW
DESIGN AXLE LOAD, TONS		9	9	9	9	7 ULTIMATE 9[2]	7 ULTIMATE 9[2]	7 ULTIMATE 9[2]
NUMBER OF LANES		MIN-4 DIVIDED	4 DIVIDED	2 (MIN)	2 (MIN.)	2	2	2
LANE WIDTH, FEET		12	12	12	12	12	12	12
SHOULDER TYPE		BITUMINOUS	BITUMINOUS	BITUMINOUS	GRAVEL	GRAVEL	GRAVEL	GRAVEL
SHOULDER WIDTH, FEET		10	8	8	8	6	4	4
MAXIMUM CURVATURE, DEGREES		3[3]	3[3]	3[3]	4[3]	5[3]	6[3]	8[3]
MAXIMUM GRADIENT, PERCENT		3[3]	3[3]	4[3]	5[3]	5[3]	6[3]	6[3]
CONTROL OF ACCESS		FULL	FULL OR PARTIAL	PARTIAL	ACCESS BY PERMIT	ACCESS BY PERMIT	ACCESS BY PERMIT	NOT REQ'D
R/W WIDTH, FEET		200'+ DISTANCE BETW. C/L		200' MINIMUM 4 LANES 150' MINIMUM 2 LANES		120	100	100
STOPPING SIGHT DISTANCE, FEET		600	600	600	600	475	350	350
PASSING OPPORTUNITIES[4]		NOT APPLICABLE		4 LANE-NOT APPLICABLE 2 LANE - ONE PER MILE		ONE PER MILE	AS AVAILABLE	
BRIDGES	WIDTH UNDER 80' LONG	(FAI 150') PAVEMENT PLUS EFFECTIVE SHOULDER WIDTH				PAVEMENT PLUS 6 FEET		
	WIDTH OVER 80' LONG	(FAI 150') PAVEMENT PLUS 6 FEET						
	LOADING	H 20 S16			H 20 S16		H 15 S12	
VERTICAL CLEARANCE, FEET[5]		16' 4"	16'	16'	16'	16'	16'	16'
RAILROAD PROTECTION		GRADE SEPARATIONS		GRADE SEPARATIONS ON 4 LANE DIVIDED ROADS AND ON 2 LANE ROADS WHERE NO. OF TRAINS EXCEEDS 6 PER DAY. FLASHING LIGHT SIGNALS ON ALL MAIN LINE CROSSINGS, ALL OTHERS FLASHING LIGHTS WHEN AVERAGE DAILY TRAFFIC X TRAINS PER DAY = 3,000. REFLECTORIZED WARNING SIGNS ON ALL OTHERS.				

1 WITH LOCAL RESTRICTIONS.
2 UNLESS NECESSARY TO PROVIDE UNRESTRICTED OUTLET TO MUNICIPALITY OVER 1,000 POPULATION.
3 MAY BE INCREASED BY 2/3 IN RUGGED OR HILLY TERRAIN.
4 A CLIMBING LANE SHALL BE PROVIDED FOR TRUCKS ON 2 LANE ROADS WHERE THE TRAFFIC IS OVER 2,000 AVERAGE DAILY TRAFFIC (12% HEAVY COMMERCIAL) AND THE PRODUCT OF THE PERCENT OF GRADE X THE LENGTH OF GRADE EXCEEDS 5,000.
5 VERTICAL CLEARANCES OF 15' ARE ALLOWABLE IN THE TWIN CITY METROPOLITAN AREA WITHIN THE F.A.I. BELTLINE, EXCEPT ON RAILROAD SEPARATIONS.

TABLE 4

NEW CONSTRUCTION DESIGN STANDARDS FOR URBAN TRUNK HIGHWAYS

SERVICE LEVEL OF FACILITY		INTERSTATE & FREEWAYS	EXPRESSWAYS	TRUNK ROUTES		FEEDER OR COLLECTOR ROUTES[2]	
1981 ADT		25,000 + HIGH LEVEL OF SERVICE	10,000-30,000 LOW LEVEL OF SERVICE	3,000-10,000	1,000-3,000	400-1,000	UNDER 400
DESIGN SPEED LIMIT, M.P.H.		MINIMUM 50	40	40	30	30	30
DESIGN AXLE LOAD, TONS		9	9	9	9	9	9
SURFACE TYPE		HIGH	HIGH	HIGH	HIGH	HIGH INTERMEDIATE	HIGH INTERMEDIATE
NUMBER OF LANES[1]		MIN. 4 DIVIDED	4 DIVIDED	4 DIVIDED OCCASIONALLY	2 OCCASIONALLY 4	2	2
LANE WIDTH, FEET		12	12	12	12	12	12
ILLUMINATION		CONTINUOUS	CONTINUOUS	[4]	INTERSECTIONS		
PARKING[3]		NO	NO	RESTRICTED OR ELIMINATED	OCCASIONALLY RESTRICTED	YES	YES
CONTROL OF ACCESS		FULL	FULL OR PART.	PARTIAL	USUALLY NONE		
MINOR CROSS STREET		TERMINATED	TERMINATED	USUALLY TERMINATED	AT GRADE		
MAJOR CROSS STREET		SEPARATED	PREFERABLY SEPARATED	AT GRADE			
CONTROL OF CROSS OR TURNING TRAFFIC AT GRADE		ALL SEPARATED	PREFERABLY SEPARATED OR STOP SIGNS	PREFERABLY STOP SIGNS - SOME TRAFFIC SIGNALS	STOP SIGNS OR TRAFFIC SIGNALS		
PRIVATE DRIVEWAYS		NONE	NONE OR FEW	RESTRICTED SOME RIGHT TURNS ONLY		YES	YES
BRIDGES	WIDTH	PAVEMENT AND MINIMUM 4'		TRAFFIC LANES + 4' + SIDEWALKS			
	LOADING	H-20 S-16					
	VERTICAL CLEARANCE	16' 4"[5]	16'[5]				16'[5]
FRONTAGE ROADS PEDESTRIAN CROSSINGS		WHERE NEEDED ELIMINATED OR SEPARATED		USUALLY NONE CROSSWALKS			
RAILROAD PROTECTION		GRADE SEPARATIONS		ELIMINATE WHERE FEASIBLE FOR 2 OR MORE TRACKS OR FOR 1 TRACK WITH 6 OR MORE TRAINS PER DAY. AUTOMATIC SIGNALS AT ALL OTHERS.		AUTOMATIC SIGNALS SPUR TRACKS MAY HAVE REFLECTORIZED CROSSBUCKS.	

1. THROUGH TRAFFIC LANES
2. THE MAJOR PORTION OF THIS CLASSIFICATION WOULD BE MADE UP OF CITY STREETS NOT ON THE TRUNK HIGHWAY SYSTEM AND THEREFORE NOT INCLUDED IN THIS STUDY.
3. PARALLEL PARKING IN LANES (8-10 FEET IN WIDTH) PROVIDED IN ADDITION TO THROUGH TRAFFIC LANES.
4. CONTINUOUS IN BUSINESS, COMMERCIAL, AND DENSE RESIDENTIAL AREAS; INTERSECTIONS IN INDUSTRIAL AND OUTLYING RESIDENTIAL AREAS.
5. VERTICAL CLEARANCE OF 15' ARE ALLOWABLE IN THE TWIN CITY METROPOLITAN AREA WITHIN THE F.A.I. BELTLINE, EXCEPT ON RAILROAD SEPARATIONS.

COLLECTION OF DATA

Five separate forms are used in the collection of data. The forms are as follows:

Form No. 2972—Roadway Data Sheet (Fig. 1).—This form contains the full identification and classification for each segment, present and future traffic data, existing and proposed road data, urban information, condition ratings and recommended construction period, space for the estimated right-of-way cost, and estimated construction involved in fulfilling the needs.

Form No. 2973—Structure Data Sheet (Fig. 2).—This form contains an abbreviated identification section for each bridge, the existing conditions, a section to indicate the adequacy of the existing structure and the recommended period of construction for the proposed improvement, the proposed improvement, and the estimated cost of the improvement.

Form No. 2974—Railroad Crossing Data Sheet (Fig. 3).—This form contains information regarding railroad crossings and is similar in nature to that in Form No. 2973.

Form No. 2975—Local Road Crossing Data Sheet (Fig. 4).—This form is used in those instances where it was necessary to do considerable work on a local road (city, county or township) in order to meet the proposed grade line or structure involved in the state highway improvement.

Form No. 2976—Right-of-Way Cost Determination Work Sheet (Fig. 5).—This form is for the use of the district engineer and the lands and right-of-way division in determining the location and estimating the cost of the right-of-way needed for the proposed improvement.

Because of the continuing nature of the study, these forms were designed to provide for the collection of information which is pertinent now or is expected to be so in the future. Because the approaching construction season produced a lack of time, the urban information section of Form No. 2972 was not used for the initial study. The spaces provided for a breakdown of the heavy commercial vehicles were not used because this information is not available on a statewide basis. However, it is expected that the balance of the information will become available over the next several years.

APPRAISAL PROCEDURES

The appraisal of the Trunk Highway System required an inspection and evaluation of each road section, bridge, and railroad grade crossing to determine: (a) which sections are presently inadequate to handle present traffic when compared to assumed minimum conditions which are considered as adequate to handle present traffic, (b) which sections are inadequate to handle the anticipated traffic 20 years hence when compared to the current construction design standards, and (c) the nature and the amount of construction required to bring each section up to these design standards. Also considered were future structural, geometric, and other inadequacies which may reasonably be anticipated to occur within the next two decades. Tables 1 through 4 give the minimum conditions and the construction design standards.

This appraisal of the Trunk Highways was made by the district engineers and their staffs. For the purpose of this study, the district engineers have indicated in which quarter of the 20-yr period such improvements should be made if funds were available at that time. Factors in this determination would be the degree of adequacy of the existing facility, and the relative urgency of the improvements.

DESIGN CRITERIA

The design criteria used throughout this study are based on the current construction designs in use in Minnesota. Typical standard designs are included as part of the cost computations. As changes in the standard designs occur, they may affect the estimated cost, and the affected quantities in the computer program may be revised to reflect this.

The standards to which each section of roadway and its related facilities are compared for adequacy are governed by the proposed service level of the facility, projected

traffic estimates, and rural or urban classification. The data supplied by the district engineers is reviewed by the Highway Needs Unit for conformance to standards, completeness, and consistency between districts prior to machine processing.

After this preliminary checking is completed, the needs study data are coded on the data sheets and then punched on tabulating cards to make up an input deck for the computer.

Traffic Data

The traffic data, both present and projected, were obtained from the Traffic Analysis Unit. The projections of the traffic volumes anticipated in 1981 are based on the trend of the traffic growth during the last ten years. The majority of these projections are the result of a computer program designed for the Traffic Analysis Unit; however, each projection is reviewed and the stations which appear to have irregular or decreasing growth rates are studied and a projection determined for each one. The needs study procedure is designed to provide for revisions of the projected traffic estimates should the growth rate vary considerably from the present projections. These projections are used by the computer in selecting the proper typical design for the cost computations where complete base, surface or shoulders are specified.

Cost Data

The major difference between this and other studies of its type is that the majority of its cost computations are performed by computer processes using: (a) a unit cost table which is programmed into the computer separately, and (b) the reported or required quantities of the various work items necessary to fulfill the construction needs on each segment of trunk highway. To develop the unit cost data, the Department's Estimating Section divided the state into twelve cost areas (Fig. 6), based on general topography, availability of construction material and labor rates. The unit costs for the work items included in the computer program are estimated for each of the twelve cost areas. These estimated unit costs are determined from recent construction contracts on the items included in the Needs Study Work Items. All bridge costs were computed by the Highway Needs Unit using average costs per sq ft of deck area. These costs, recommended by the Bridge Section, were varied by the type of service, skew, and bridge width; in the case of concrete box culverts, the cost per foot was estimated for each of the several types in use. Railroad protection costs were estimated by the district engineers from a range of costs furnished for each type of protection. Roadside development costs were estimated by the district engineers since this item varies considerably within each cost area. Right-of-way costs, though not currently available, are being estimated by the Lands and Right-of-Way Section.

Computer Programs

The needs study involves a series of computer programs which perform several functions. The five functions are (a) to edit the input data for invalid coding or conditions wherever possible, (b) to assemble a magnetic tape file containing the input data, (c) to update the input data tape to reflect the current conditions and proposed improvements on each highway segment, (d) to compute the estimated costs of construction, and (e) to print a variety of listings and reports showing the mileage and cost of the proposed construction by various breakdowns.

The initial computer program (Program A) is designed to perform the first two of these. This program is written so that the edit function is always performed, while the tape assembly may or may not be performed. The input to this program is a deck of punched tabulating cards containing the information from the data sheets. The program performs approximately 150 edits on each segment for which there is a set of data cards, resulting in a printed list of the errors which were detected. These errors are invalid cards due to faulty reporting, coding, keypunching, errors in card sequence, or incomplete sets of cards. In assembling the tape, tabulating cards numbered 1 through 10 which contain the data from the Roadway Data Sheet—Form No. 2972 must be present. The limit on the number of bridges, railroad crossings, and local road

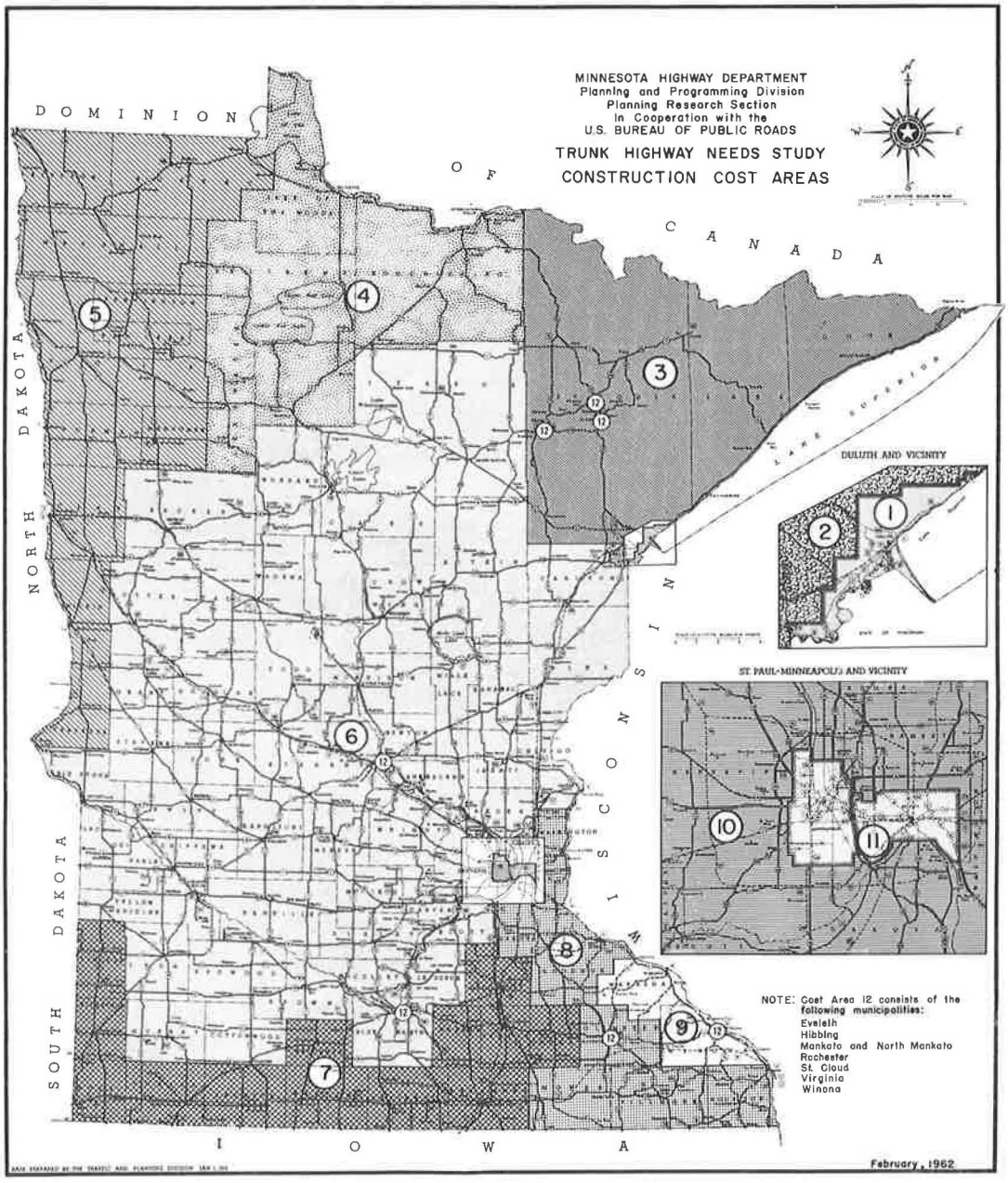


Figure 6.

crossings which can be included with each section is determined by the total number of positions allotted for this supplementary data. The available space provides for a maximum of 15 bridges per segment; however, this number would be reduced if railroad or local road crossings are also required in the segment. Figure 7 shows the flow of the various operations involved in Program A and Program B.

If an existing tape is to be updated, Program A may be used to perform the edits on the corrected data cards prior to the updating. When used in this manner, the instructions must state that the production on this program is for edit only. In this case, a

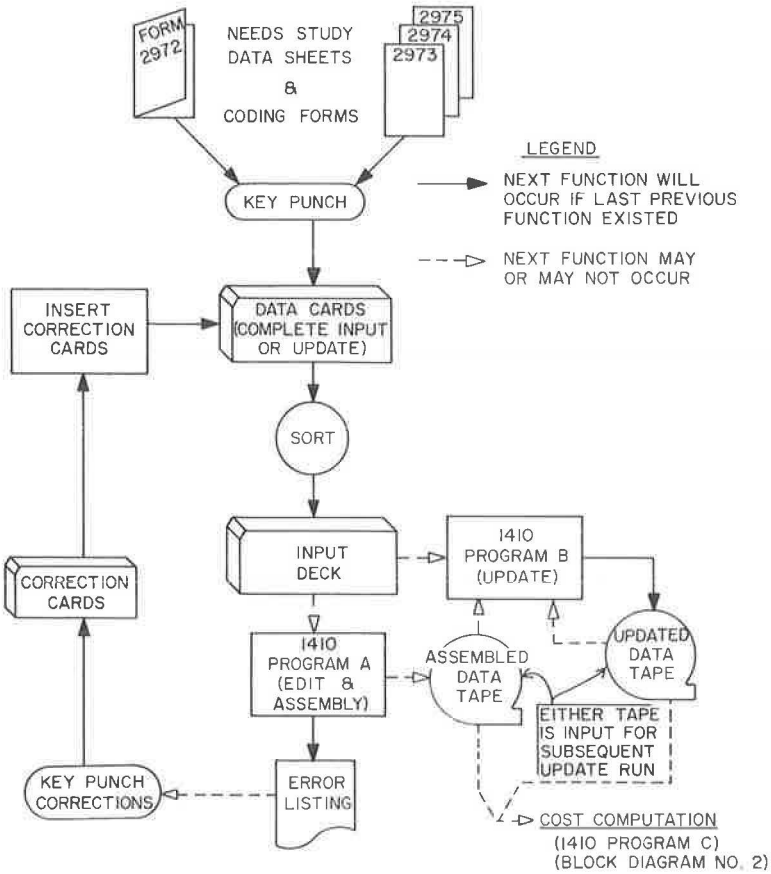


Figure 7. Data tape assembly and update.

data tape will not be assembled, although a listing of the edit errors will be printed. The input deck to Program A may represent the entire Trunk Highway System or any part of it, as long as the proper sequencing of cards entered as input is maintained; thus, each time Program A is run for editing purposes and the corrections for errors noted in the listing are made, only those sections which had errors need to be re-edited.

Computer Program B is designed to update an existing Trunk Highway Needs Study data tape; this is the third function of the computer program. A segment which is on the existing tape may be corrected, deleted, or left undisturbed; a new segment may also be added to those already on the tape. In this program, the existing data for a segment to be corrected is completely removed from the tape and a new set of data is inserted. Thus, for segments to be corrected as well as for the new segments, the entire set of data cards for the segment (10 roadway data cards plus any bridge, railroad or local road crossing cards for the segment) must be included with the input. The limitations on the positions available for supplementary data are the same as for Program A. To delete a segment from the tape, a delete card is used which removes all the data for the segment to be eliminated from the tape.

The fourth computer function is carried out by Program C (Fig. 8). This program computes for each segment the costs of all the various work items that comprise the proposed construction on the segment. This is accomplished by using the data tape assembled by either Program A or Program B and a deck of cost cards containing unit prices for each item by cost area. Program C is split into two phases; the first produces a printed image of the unit cost table as it appears within the program, and the

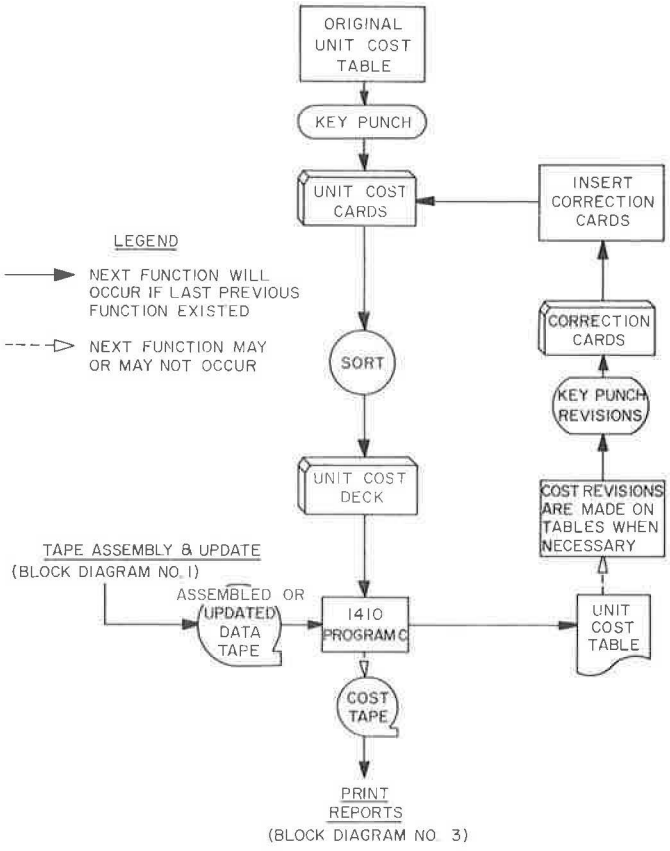


Figure 8. Cost computation.

second performs the cost computations. The first phase serves as a check to make sure that the proper unit costs are being used in the cost computations. After completion of the first phase of the program, the use of the second phase is optional; thus, the program may be used only for the purpose of updating and checking the unit costs. When it is necessary to revise any of the unit costs, the revisions are marked on the cost table produced from the last cost deck and the new unit costs cards are keypunched directly from this.

Included in the cost computation program itself are tables of precalculated quantities used for the complete construction items as related to the various design specifications and the numerous cost computation formulas for each cost item. As changes in the standard designs occur, the affected quantities in the computer program may be revised to reflect the effect of change in design on the estimated cost.

The input data on base, surface, and shoulder specify whether partial or complete construction of these items is required. If partial construction is shown, the quantities of materials to be used in the cost formulas are also specified as part of the input. If complete construction is indicated, the program determines the exact design to be used from the traffic volume and type of construction. After determining the proper design, it refers to the quantity tables to obtain the quantities associated with that design for use in the cost formulas. The end result of Program C, phase 2, is a cost tape. This tape contains the identification and classification, traffic volumes, as well as the costs for each item of work required within each segment. It is from this tape that the various summaries and listings are obtained, either directly or indirectly.

The production of the various reports (listings and summaries) from the cost tape is shown schematically in Figure 9. The majority of the needs study reports come directly

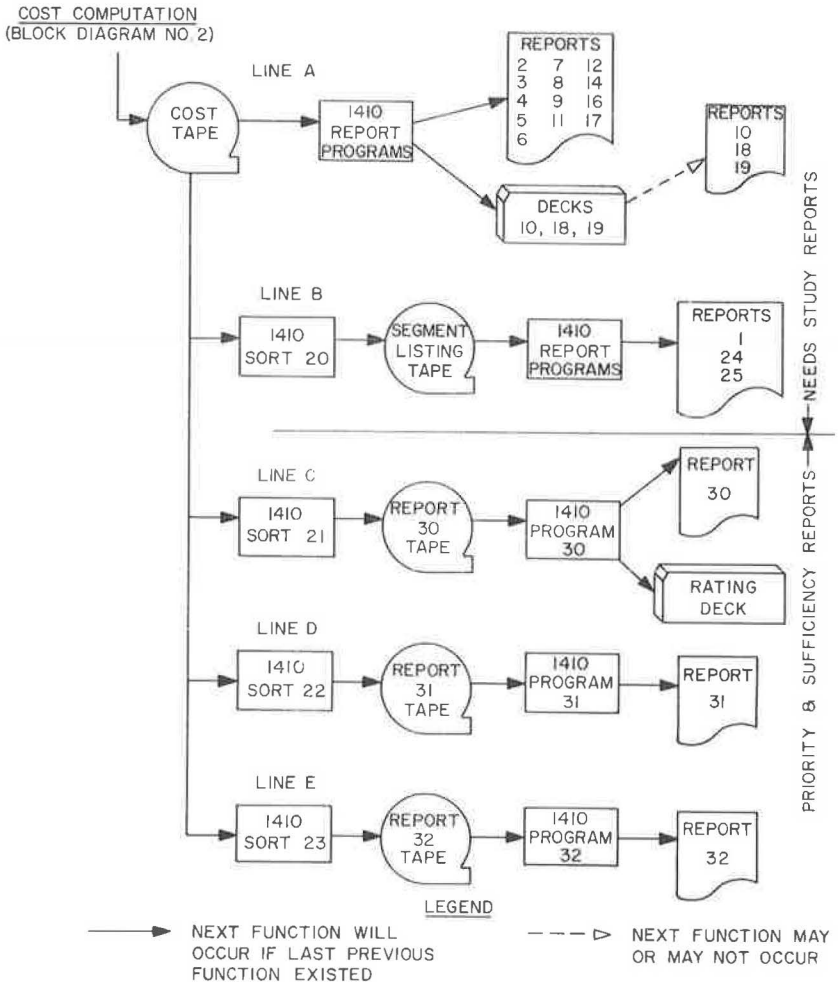


Figure 9. Print reports.

from the cost tape (line A); three are derived from output decks (line A); and three are obtained from a segment listing tape derived from the cost tape (line B). The balance of the programs (lines C, D, and E) enable the Data Correlation Unit to utilize the condition ratings contained in the needs study for developing sufficiency ratings. These ratings and the needs study estimates are being used by the Construction Program Unit in establishing construction programs. A list of the programmed reports is included in the Appendix.

The date of production is inserted in the tape label to differentiate between tapes made at different times. This date will be carried forward to the "cost tape" (see Program C). The "year" portion of this date will automatically be printed on all reports subsequently printed directly from this cost tape. On reports which are printed from sorted tapes, the year must be inserted by the computer console operator using the date on the label of the Trunk Highway Needs Study update tape.

CONCLUSION

To date, the results obtained from this study and the related computer programs have been satisfactory. The many edits contained in the program help considerably to

reduce the clerical errors which appear in any large volume of work such as this study entails. The original assembled tape was updated three times within the 6-month period following its production: the first made minor corrections to the original data; the second update removed the needs covered by contracts awarded during the first half of calendar year 1962 and reflected the changes in corporate limits, Federal designation and load-carrying capacity which had occurred since January 1962; the third update reflected the results of the rearrangement of the area covered by two districts and contracts awarded through the first quarter of the 1963 calendar year. Listings of the cost of the proposed improvements on each highway segment and bridge and tabulated summaries of costs furnished to the district engineers and Program Development Section have been well received. Based on experience so far, the needs study is easily maintained; therefore, it can be used for a number of years. We feel that the features designed into the Minnesota Trunk Highway Needs Study allow for enough flexibility for the study to be maintained on a continuing basis.

Many of the tabulated reports are produced by the computer in a format suitable for inclusion in reports furnished to the legislature and highway-related organizations. Reproductions of portions of several of the listings and tabulations are included in the Appendix.

The computer programs (IBM Model 1410) are documented and copies will be made available on request to the authors.

Appendix

TRUNK HIGHWAY NEEDS STUDY REPORTS

Report

1. Segment Listing of Estimated Costs for Major Work Items with Control Section and District Totals.
2. Tabulation of Estimated Costs and Proposed Miles for Individual Work Items, by County, District, and Statewide.
3. County Tabulation of Proposed Miles and Estimated Costs for Plan B and Plan A by Variance in Design with District and State Totals.
4. Tabulation of Miles and Estimated Costs by Legal Designation, by County, District, and Statewide.
5. Tabulation of Miles and Estimated Costs by Service: Level of Facility and Urban Classification, by District and Statewide.
6. Tabulation of Miles and Estimated Costs by Federal Designation and Urban Classification, by County, District, and Statewide.
7. Tabulation of Miles and Estimated Costs by Urban and Municipal Classifications, by County, District, and Statewide.
8. Tabulation of Miles and Estimated Costs by Type of Project, by County, District, and Statewide, with District and State Project Type Summaries.
9. Tabulation of Estimated Costs and Proposed Miles by Present and Proposed Load Restriction, by County, District, and Statewide.
10. Segment Listing of Estimated Costs and Existing Miles of Potential Trunk Highway Turnbacks by Service Level of Facility with Totals by Legal Designation.
11. Tabulation of Estimated Costs and Existing Miles by Type of Project by Period of Deficiency, by County, District, and Statewide.
12. Segment Listing of 20-to-22 Foot Wide Concrete Pavement by Trunk Highway Number.
13. Canceled.
14. Tabulation of Estimated Costs and Proposed Miles by Type of Project and Recommended Construction Period, by District and Statewide.
15. Canceled.
16. Tabulation of Estimated Costs and Existing and Proposed Miles by Federal Designation by Rural/Urban Classification by Present ADT, by District and Statewide.
17. Tabulation of Estimated Costs and Existing and Proposed Miles by Federal Designation by Rural/Urban Classification by Projected ADT, by District and Statewide.
18. Card Output for Trunk Highway Needs and County State Aid Needs Comparison.
19. Card Output for Miscellaneous Tabulated Summaries.
24. Listing of Existing and Proposed Bridges with Estimated Cost of Construction or Reconstruction, by District.
25. Tabulation of the Number of Existing and Proposed Bridges and Estimated Costs by Type of Service, by Type of Work, by County Within District, by District, and Statewide, with District and State Totals by Federal Designation and Service Level.
30. A. Statewide Rural Condition Rating Listing by Adjusted Rating, Control Section, and Segment.
    B. Rural Condition Rating Output Deck.
31. Rural Condition Rating Listing by District by Adjusted Rating, Control Section, and Segment.
32. Rural Condition Rating Listing by District by Trunk Highway, Control Section, and Segment.

MINNESOTA HIGHWAY DEPARTMENT
PLANNING AND PROGRAMMING DIVISION
PLANNING RESEARCH SECTION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
1963 TRUNK HIGHWAY NEEDS STUDY

TABULATION OF MILES AND ESTIMATED COSTS
BY URBAN AND MUNICIPAL CLASSIFICATIONS
BY COUNTY, DISTRICT, AND STATEWIDE

TYPICAL TITLE SHEET

REPORT NO. 1
SEGMENT LISTING
(1963 Data)

T H 274	0.46 M S TO N L WOOD LAKE		CONT SECT 8714	SEG 010	DIST 8	EXISTING MILES	.46	PROPOSED MILES	.46		
WOOD LAKE	EXISTING NOT DIVIDED		BIT SURFACE 24 FT	26 FT	YR GRADE 48	YR SURFACE 50		SECONDARY RURAL			
PROJECT TYPE - GRADE, BASE, AND BITUMINOUS			PROPOSED DESIGN RURAL		9 TON	PROJECTED ADT 1727		COLLECTOR			
PRELIMINARY ENGINEERING	$		BASE		$ 10,900	RETAINING WALLS		$			
RIGHT OF WAY			SURFACE AND SHOULDERS		5,600	RAILROAD PROTECTION			7,000		
CLEARING AND GRUBBING		300	RAILROAD GRADE SEPARATIONS			HIGHWAY PROTECTION					
DEMOLITION		300	HIGHWAY GRADE SEPARATIONS			ROADSIDE DEVELOPMENT					
UTILITY ADJUSTMENT		500	INTERCHANGES			MISCELLANEOUS ITEMS					
GRADING + MINOR STRUCTURES		6,700	OTHER BRIDGES AND TUNNELS			ENGINEERING + CONTINGENCIES			3,130		
						TOTAL COST		$	34,400		
T H 274	N L WOOD LAKE TO TH 67		CONT SECT 8714	SEG 020	DIST 8	EXISTING MILES	8.51	PROPOSED MILES	8.37		
RURAL	EXISTING NOT DIVIDED		BIT SURFACE 24 FT	26 FT	YR GRADE 48	YR SURFACE 50		SECONDARY RURAL			
PROJECT TYPE - GRADE, BASE, AND BITUMINOUS			PROPOSED DESIGN RURAL		9 TON	PROJECTED ADT 936		COLLECTOR			
PRELIMINARY ENGINEERING	$		BASE		$ 162,900	RETAINING WALLS		$			
RIGHT OF WAY			SURFACE AND SHOULDERS		60,700	RAILROAD PROTECTION					
CLEARING AND GRUBBING		14,600	RAILROAD GRADE SEPARATIONS			HIGHWAY PROTECTION			2,400		
DEMOLITION		5,400	HIGHWAY GRADE SEPARATIONS			ROADSIDE DEVELOPMENT					
UTILITY ADJUSTMENT		8,900	INTERCHANGES			MISCELLANEOUS ITEMS					
GRADING + MINOR STRUCTURES		211,600	OTHER BRIDGES AND TUNNELS		133,000	ENGINEERING + CONTINGENCIES			59,950		
						TOTAL COST		$	659,500		
BRIDGES	MHD BR NO 04608	8.10 NWOOD L	YR 26	EXIST STREAM X-ING	PROP STREAM X-ING	NEW STRUCTURE		COST $	47,000		
	MHD BR NO 04584	4.70 NWOOD L	YR	EXIST STREAM X-ING	PROP STREAM X-ING	NEW STRUCTURE		COST $	86,000		
TOTAL CONTROL SECTION 8714	EXISTING MILES	8.97	MILES OF PROPOSED CONSTRUCTION		8.83						
PRELIMINARY ENGINEERING	$		BASE		$ 173,800	RETAINING WALLS		$			
RIGHT OF WAY			SURFACE AND SHOULDERS		66,300	RAILROAD PROTECTION			7,000		
CLEARING AND GRUBBING		14,900	RAILROAD GRADE SEPARATIONS			HIGHWAY PROTECTION			2,400		
DEMOLITION		5,700	HIGHWAY GRADE SEPARATIONS			ROADSIDE DEVELOPMENT					
UTILITY ADJUSTMENT		9,400	INTERCHANGES			MISCELLANEOUS ITEMS					
GRADING + MINOR STRUCTURES		218,300	OTHER BRIDGES AND TUNNELS		133,000	ENGINEERING + CONTINGENCIES			63,080		
						TOTAL COST		$	693,900		
TOTAL COUNTY 87 DISTRICT 8	EXISTING MILES	133.55	MILES OF PROPOSED CONSTRUCTION		133.41						
PRELIMINARY ENGINEERING	$		BASE		$ 1,924,800	RETAINING WALLS		$			
RIGHT OF WAY			SURFACE AND SHOULDERS		2,190,200	RAILROAD PROTECTION			17,000		
CLEARING AND GRUBBING		90,300	RAILROAD GRADE SEPARATIONS		308,000	HIGHWAY PROTECTION			74,900		
DEMOLITION		32,500	HIGHWAY GRADE SEPARATIONS			ROADSIDE DEVELOPMENT					
UTILITY ADJUSTMENT		60,900	INTERCHANGES			MISCELLANEOUS ITEMS			162,500		
GRADING + MINOR STRUCTURES		2,544,700	OTHER BRIDGES AND TUNNELS		1,966,000	ENGINEERING + CONTINGENCIES			927,180		
						TOTAL COST		$	10,199,200		
TOTAL DISTRICT 8	EXISTING MILES	1457.62	MILES OF PROPOSED CONSTRUCTION		1431.88						
PRELIMINARY ENGINEERING	$		BASE		$15,492,700	RETAINING WALLS		$			
RIGHT OF WAY			SURFACE AND SHOULDERS		34,260,900	RAILROAD PROTECTION			221,400		
CLEARING AND GRUBBING		600,800	RAILROAD GRADE SEPARATIONS		2,699,000	HIGHWAY PROTECTION			835,200		
DEMOLITION		265,600	HIGHWAY GRADE SEPARATIONS		73,000	ROADSIDE DEVELOPMENT					
UTILITY ADJUSTMENT		609,600	INTERCHANGES		539,000	MISCELLANEOUS ITEMS			764,000		
GRADING + MINOR STRUCTURES		25,498,100	OTHER BRIDGES AND TUNNELS		8,049,000	ENGINEERING + CONTINGENCIES			8,990,830		
						TOTAL COST		$	90,903,000		

REPORT NO. 2
TABULATION OF INDIVIDUAL WORK ITEMS
(1962 Data)

STATEWIDE TOTAL

GRADING	RESHAPE ONLY MILES	RESHAPE ONLY COST	WIDEN ONLY MILES	WIDEN ONLY COST	REGRADE + WIDEN MILES	REGRADE + WIDEN COST	REGRADE COMPLETE MILES	REGRADE COMPLETE COST	NEW ALIGNMENT MILES	NEW ALIGNMENT COST
RIGHT OF WAY		$		$		$		$		$
CLEAN AND GRUB	12.52	5,700	1216.80	1,584,700	1272.75	2,228,100	2189.33	3,610,000	1325.36	2,324,700
DEMOLITION	5.97	20,100	108.59	205,300	465.46	600,400	1043.79	1,053,800	889.33	2,157,400
REMOVAL ITEMS										
CLASS A		1,343,600		28,147,600		31,096,100		75,493,100		58,499,100
B				3,501,700		2,546,300		15,228,100		10,743,300
A BORROW				5,805,900		1,111,100		1,555,600		3,660,200
B BORROW				3,600				375,000		40,800
SWAMP EXCAV	38.65	319,500	236.74	944,500	416.36	2,348,800	1316.28	6,267,400	608.47	4,968,000
SWAMP BACKFILL	28.16	552,300	229.18	1,881,700	468.24	5,134,200	1195.02	13,537,400	525.01	11,250,700
ROCK EXCAV ASR			12.86	22,000			.12	45,000	.05	4,500
ALR										
AIR			63.62	77,100	156.69	274,500	113.45	484,800	99.95	404,400
MINOR STR U10 NO.	16	90,700	98	6,323,800	414	2,420,800	415	2,409,500	228	1,333,300
C10 NO.	18	197,400	247	2,665,000	65	734,300	109	1,244,000	112	1,272,800
LOCAL RD CROSS NO.			1	113,000					2	79,000
NC GRADING	2129.39 MILES									

BASE	COMPLETE BASE MILES	COMPLETE BASE COST	WIDENING MILES	WIDENING COST	STRENGTHENING MILES	STRENGTHENING COST
GRAVEL	2953.72	$42,466,500	1851.75	$14,891,600	252.62	$ 1,970,900
BITUMINOUS	2624.26	67,185,500	776.12	9,341,200	646.14	9,163,900
SOIL CEMENT	18.50	462,700				
SF CONCRETE			116.17	1,141,500		
FORMED CONC	34.57	4,553,800	595.46	8,235,400	21.88	336,500
NC BASE	3249.44 MILES					

SURFACING	MAIN ROADWAY MILES	MAIN ROADWAY COST		ACCESSORY ROADS MILES	ACCESSORY ROADS COST*
NONE	1542.32	$	RAMPS	184.43	$17,985,500
ADDITIONAL BITUMINOUS	5044.86	67,647,500	CLIMBING LANES	16.80	625,400
COMPLETE BITUMINOUS	4760.96	56,907,400	FRONTAGE ROADS	132.74	4,269,800
SLIP FORM CONCRETE	383.42	20,922,700			
FORMED CONCRETE NON-REINF	550.76	29,613,100			
FORMED CONCRETE REINFORCED	1392.83	84,240,500	* INCLUDES BASE AND SURFACE COSTS		

SHOULDERING	MILES	COST
COMPLETE	9367.14	$41,014,500
RESHOULDERING	1261.01	2,889,000

MISCELLANEOUS ITEMS

	MILES	COST
FENCING	229.25	$ 4,876,700
SIGNING	485.77	9,834,000

	LIN FT	COST
STORM SEWERS	173,400	$14,976,300
CURB	722,600	1,443,600
CURB + GUTTER	302,200	16,000,400
GUARD RAIL	251,900	5,179,200

	NO.	COST
LIGHTING PARTIAL	1,861	$ 1,861,000
CONTINUOUS	2,435	1,824,000
TRF SGNLS FLASHING BEACONS	36	23,000
ISOLATED PRETIMED	135	810,000
INTERCON PRETIMED	45	405,000
TRAFFIC ACTUATED	179	2,148,000
TRAFFIC ADJ 3 TO 5	22	525,000
TRAFFIC ADJ OVER 5	6	89,000

	COST
ROADSIDE DEVELOP	$ 70,000
OTHER COSTS	$ 2,451,700

	SQ FT	COST
SIDEWALK	785,200	$ 733,000

	NUMBER ADEQUATE	NUMBER DEFICIENT	COST
RAILROAD GRADE SEPARATIONS	215	280	$63,045,000
HIGHWAY GRADE SEPARATIONS	27	137	16,181,000
HIGHWAY INTERCHANGES	92	287	43,730,000
OTHER BRIDGES AND TUNNELS	721	166	8,503,000
RAILROAD PROTECTION SIGNS	73	9	10,800
SIGNALS	168	222	1,706,000
SIG + GATES	11	35	572,000
UTILITY ADJUSTMENT			11,794,200
ENGINEERING AND CONTINGENCIES			16,763,000

TOTAL COST	$1,218,077,300
TOTAL EXISTING MILEAGE	11,817.16
TOTAL PROPOSED MILEAGE	12,232.44

REPORT NO. 5
TABULATION OF MILES AND ESTIMATED COSTS BY SERVICE LEVEL
(1963 Data)

00289

DISTRICT 9

SERVICE LEVEL	RURAL			URBAN			TOTAL		
	EXISTING MILES	PROPOSED MILES	COST	EXISTING MILES	PROPOSED MILES	COST	EXISTING MILES	PROPOSED MILES	COST
FREEWAY	.00	11.50	$ 5,307,200	5.67	7.59	$ 13,980,300	5.67	19.09	$ 19,287,500
EXPRESSWAY	97.29	101.07	$ 21,320,800	72.18	64.16	$ 32,105,100	169.47	165.23	$ 53,425,900
TRUNK ROUTE	182.08	169.93	$ 13,911,400	71.65	64.10	$ 16,779,700	253.73	234.03	$ 30,691,100
SUB-TOTAL 1-3	279.37	282.50	$ 40,539,400	149.50	135.85	$ 62,865,100	428.87	418.35	$ 103,404,500
COLLECTOR 4	72.96	28.36	$ 1,536,900	34.81	18.98	$ 2,622,900	107.77	47.34	$ 4,159,800
COLLECTOR 5	15.58	14.09	$ 682,500	6.38	5.84	$ 965,700	21.96	19.93	$ 1,648,200
COLLECTOR 6	.00	.00	$ 0	.00	.00	$ 0	.00	.00	$ 0
SUB-TOTAL 4-6	88.54	42.45	$ 2,219,400	41.19	24.82	$ 3,588,600	129.73	67.27	$ 5,808,000
TOTAL	367.91	324.95	$ 42,758,800	190.69	160.67	$ 66,453,700	558.60	485.62	$ 109,212,500

00288

STATE TOTALS

SERVICE LEVEL	RURAL			URBAN			TOTAL		
	EXISTING MILES	PROPOSED MILES	COST	EXISTING MILES	PROPOSED MILES	COST	EXISTING MILES	PROPOSED MILES	COST
FREEWAY	121.71	118.19	$ 19,443,600	118.38	130.03	$ 149,309,700	240.09	248.22	$ 168,753,300
EXPRESSWAY	1,213.66	1,219.76	$ 250,832,100	249.58	222.73	$ 98,952,600	1,463.24	1,442.49	$ 349,784,700
TRUNK ROUTE	5,505.96	5,130.95	$ 355,406,100	179.97	160.21	$ 40,926,200	5,685.93	5,291.16	$ 396,332,300
SUB-TOTAL 1-3	6,841.33	6,468.90	$ 625,681,800	547.93	512.97	$ 289,188,500	7,389.26	6,981.87	$ 914,870,300
COLLECTOR 4	1,908.60	1,637.47	$ 96,533,000	129.69	75.40	$ 17,877,900	2,038.29	1,712.87	$ 114,410,900
COLLECTOR 5	1,353.77	1,325.36	$ 85,797,600	40.51	34.12	$ 9,432,600	1,394.28	1,359.48	$ 95,230,200
COLLECTOR 6	1,001.12	1,008.77	$ 64,527,900	4.91	4.81	$ 1,296,700	1,006.03	1,013.58	$ 65,824,600
SUB-TOTAL 4-6	4,263.49	3,971.60	$ 246,858,500	175.11	114.33	$ 28,607,200	4,438.60	4,085.93	$ 275,465,700
TOTAL	11,104.82	10,440.50	$ 872,540,300	723.04	627.30	$ 317,795,700	11,827.86	11,067.80	$ 1,190,336,000

REPORT NO. 6
TABULATION OF MILES AND ESTIMATED COSTS BY FEDERAL DESIGNATION
(1963 Data)

DISTRICT / FEDERAL DESIGNATION	RURAL EXISTING MILES	RURAL PROPOSED MILES	RURAL COST	URBAN EXISTING MILES	URBAN PROPOSED MILES	URBAN COST	TOTAL EXISTING MILES	TOTAL PROPOSED MILES	TOTAL COST
DISTRICT 6									
INTERSTATE			$			$			$
PRIMARY	876.76	789.41	108,900,600	65.01	45.41	12,381,100	941.77	834.82	121,281,700
SECONDARY	424.81	414.84	44,295,100	5.97	4.72	2,065,300	430.78	419.56	46,360,400
NON-FEDERAL				4.09	2.93	299,500	4.09	2.93	299,500
TOTAL	1,301.57	1,204.25	$ 153,195,700	75.07	53.06	$ 14,745,900	1,376.64	1,257.31	$ 167,941,600
DISTRICT 7									
INTERSTATE			$			$			$
PRIMARY	870.49	816.24	67,173,900	35.44	27.16	9,873,400	905.93	843.40	77,047,300
SECONDARY	423.46	422.86	28,780,000	3.61	1.27	87,000	427.07	424.13	28,867,000
NON-FEDERAL	1.46	.86	693,900	1.18	1.18	178,500	2.64	2.04	872,400
TOTAL	1,295.41	1,239.96	$ 96,647,800	40.23	29.61	$ 10,138,900	1,335.64	1,269.57	$ 106,786,700
DISTRICT 8									
INTERSTATE			$			$			$
PRIMARY	988.31	966.39	70,727,900	25.14	21.84	1,201,300	1,013.45	988.23	71,929,200
SECONDARY	442.19	441.67	26,926,500	1.46	1.48	43,000	443.67	443.15	26,969,500
NON-FEDERAL	.50	.50	4,300				.50	.50	4,300
TOTAL	1,431.00	1,408.56	$ 97,658,700	26.62	23.32	$ 1,244,300	1,457.62	1,431.88	$ 98,903,000
DISTRICT 9									
INTERSTATE			$			$			$
PRIMARY	311.01	270.29	38,467,700	169.78	143.29	61,022,300	480.79	413.58	99,490,000
SECONDARY	56.90	54.66	4,291,100	6.47	6.23	1,127,100	63.37	60.89	5,418,200
NON-FEDERAL				14.44	11.15	4,304,300	14.44	11.15	4,304,300
TOTAL	367.91	324.95	$ 42,758,800	190.69	160.67	$ 66,453,700	558.60	485.62	$ 109,212,500
STATE TOTALS									
INTERSTATE			$			$			$
PRIMARY	4,987.82	4,386.29	585,496,700	635.62	556.71	287,880,700	7,623.44	6,943.00	873,377,400
SECONDARY	4,092.76	4,039.68	283,496,700	40.56	26.03	8,299,600	4,133.32	4,065.71	291,796,300
NON-FEDERAL	24.24	14.53	3,546,900	46.86	44.56	21,615,400	71.10	59.09	25,162,300
TOTAL	11,104.82	10,440.50	$ 872,540,300	723.04	627.30	$ 317,795,700	11,827.86	11,067.80	$1,190,336,000

REPORT NO. 8
TABULATION OF MILES AND ESTIMATED COSTS BY PROJECT TYPE
(1963 Data)

DISTRICT	PROJECT CODES	TYPE OF PROJECT	EXISTING MILES	PROPOSED MILES	COST
DISTRICT 7	00	NO CONSTRUCTION	121.08		$
	01,02,03	SURFACING	7.03	7.03	258,000
	04,05,06,07	BASE + SURFACE	23.58	23.58	1,194,800
	08,09	COMPLETE	244.17	288.75	58,973,300
	10,11,12,13	REGRADE,WIDEN, AND RESURFACE	820.79	831.22	43,677,000
	14	MISCELLANEOUS	118.99	118.99	2,683,600
	TOTAL		1,335.64	1,269.57	$ 106,786,700
DISTRICT 8	00	NO CONSTRUCTION	45.29		$
	01,02,03	SURFACING	104.79	104.79	3,238,000
	04,05,06,07	BASE + SURFACE	11.93	12.01	502,600
	08,09	COMPLETE	189.12	205.46	26,088,400
	10,11,12,13	REGRADE,WIDEN, AND RESURFACE	1,045.18	1,043.37	67,668,200
	14	MISCELLANEOUS	61.25	61.25	1,405,800
	TOTAL		1,457.62	1,431.88	$ 98,903,000
STATEWIDE TOTALS	00	NO CONSTRUCTION	1,165.13		$
	01,02,03	SURFACING	822.86	819.69	30,979,100
	04,05,06,07	BASE + SURFACE	130.41	130.34	7,111,700
	08,09	COMPLETE	3,328.33	3,728.72	705,987,300
	10,11,12,13	REGRADE,WIDEN, AND RESURFACE	5,801.36	5,810.35	399,715,800
	14	MISCELLANEOUS	579.77	578.70	46,542,100
	TOTAL		11,827.86	11,067.80	$1,190,336,000

REPORT NO. 9
TABULATION OF MILES AND ESTIMATED COSTS
BY
PRESENT AND PROPOSED SPRINGTIME LOAD RESTRICTION
(1963 Data)

DISTRICT PRESENT LOAD RESTRICTION	PROPOSED 7-TON ULT 9-TON MILES	 COST	PROPOSED 9-TON MILES	 COST	TOTAL MILES	 COST
DISTRICT 1						
NON-EXIST	.12	$ 6,500	59.33	$ 23,605,400	59.45	$ 23,611,900
3-TON						
4-TON	162.11	15,341,700	62.23	8,219,400	224.34	23,561,100
5-TON	240.96	11,978,800	107.19	7,970,900	348.15	19,949,700
6-TON	53.34	2,596,000	38.59	3,047,800	91.93	5,643,800
7-TON	82.62	3,390,300	213.23	22,584,000	295.85	25,974,300
8-TON						
9-TON	3.37	167,000	492.39	78,308,600	495.76	78,475,600
TOTAL	542.52	$ 33,480,300	972.96	$ 143,736,100	1,515.48	$ 177,216,400
DISTRICT 2						
NON-EXIST	18.21	$ 1,713,300	4.55	$ 2,615,500	22.76	$ 4,328,800
3-TON						
4-TON	172.85	9,495,800	42.56	4,284,600	215.41	13,779,400
5-TON	195.95	10,916,100	146.99	9,837,200	342.94	20,753,300
6-TON	119.84	4,737,300	166.23	8,994,400	286.07	13,731,700
7-TON	120.64	3,287,300	279.66	10,788,700	400.30	14,076,000
8-TON						
9-TON	1.49	15,400	445.45	35,167,200	446.94	35,182,600
TOTAL	628.98	$ 30,164,200	1,085.44	$ 71,687,600	1,714.42	$ 101,851,800
STATEWIDE TOTALS						
NON-EXIST	67.26	$ 5,819,700	341.86	$ 154,274,000	409.12	$ 160,093,700
3-TON						
4-TON	814.67	77,753,400	220.70	29,203,300	1,035.37	106,956,700
5-TON	1,231.58	71,187,500	1,142.46	87,713,000	2,374.04	158,900,500
6-TON	469.52	22,905,100	718.81	54,776,500	1,188.33	77,681,900
7-TON	388.50	16,607,800	1,400.11	102,085,700	1,788.61	118,693,500
8-TON						
9-TON	36.55	1,890,600	4,235.78	566,119,100	4,272.33	568,009,700
TOTAL	3,008.08	$ 196,164,100	8,059.72	$ 994,111,900	11,067.80	$1,190,336,000

REPORT NO. 24
LISTING OF EXISTING AND PROPOSED BRIDGES
(1963 Data)

DIST 1 TH 169 MHD BR NO 2112 2.70 EKEWATN — EXISTING STREAM 24 FT W106D — BUILT 32 COSTS- R/W $ 0
CONT SEC 6934 SEGMENT 010 FAP EXPRESSWAY — RDWAY 42 FT, SDWKS NONE — LOAD 20T — APPROACH 0
PROJ ADT 8,312 PLACEMENT-SQUARE — PROPOSED STREAM RECONSTR 24 FT C106D — STRUCTURE 20,000
PRESENT STRUCTURE DEFICIENT - GEOMETRICS — RDWAY 130 FT, SDWKS NONE DESIGN H20-S16 — TOTAL $ 20,000
RECOMMENDED CONSTRUCTION WITHIN 5 YRS.

DIST 1 TH 169 MHD BR NO 5207 3.30 EKEWATN — EXISTING HWY/RR 170 FT D P G — BUILT 34 COSTS- R/W $ 0
CONT SEC 6934 SEGMENT 010 FAP EXPRESSWAY — RDWAY 27 FT, SDWKS NONE — LOAD 20T — APPROACH 2,000
PROJ ADT 8,312 PLACEMENT-SQUARE — PROPOSED HWY/RR REPL-SAME 170 FT — STRUCTURE 90,000
PRESENT STRUCTURE ADEQUATE — RDWAY 30 FT, SDWKS NONE DESIGN H20-S16 — TOTAL $ 92,000
DEFICIENT WITHIN 15 YRS. - GEOMETRICS — RECOMMENDED CONSTRUCTION WITHIN 20 YRS.

DIST 1 TH 169 MHD BR NO 3.30 EKEWATN — EXISTING NONE — COSTS- R/W $ 0
CONT SEC 6934 SEGMENT 010 FAP EXPRESSWAY — APPROACH 2,000
PROJ ADT 8,312 PLACEMENT- — PROPOSED HWY/RR NEW BRIDGE 170 FT — STRUCTURE 90,000
RDWAY 30 FT, SDWKS NONE DESIGN H20-S16 — TOTAL $ 92,000
RECOMMENDED CONSTRUCTION WITHIN 5 YRS.

DIST 1 TH 73 MHD BR NO 6234 AT WIBBING — EXISTING HWY/RR 115 FT C S — BUILT NR COSTS- R/W $ 0
CONT SEC 6936 SEGMENT 040 TRUNK — RDWAY 23 FT, SDWKS NONE — LOAD 20T — APPROACH 0
PROJ ADT 8,312 PLACEMENT-SKEW — PROPOSED HWY/RR REPL-SAME 144 FT — STRUCTURE 78,000
PRESENT STRUCTURE DEFICIENT - GEOMETRICS — RDWAY 30 FT, SDWKS NONE DESIGN H20-S16 — TOTAL $ 78,000
RECOMMENDED CONSTRUCTION WITHIN YRS.

DIST 1 TH 169 MHD BR NO 69002 2.00 NE TH73 — EXISTING HWY/RR 148 FT 8 S — BUILT 61
CONT SEC 6934 SEGMENT 130 FAP EXPRESSWAY — RDWAY 62 FT, SDWKS NONE — LOAD 20T
PROJ ADT 10,400 PLACEMENT-SKEW
PRESENT STRUCTURE ADEQUATE

DIST 1 TH 169 MHD BR NO 69003 2.00 NESTH73 — EXISTING HWY/RR 196 FT 8 S — BUILT 61
CONT SEC 6934 SEGMENT 130 FAP EXPRESSWAY — RDWAY 62 FT, SDWKS NONE — LOAD 20T
PROJ ADT 10,400 PLACEMENT-SKEW
PRESENT STRUCTURE ADEQUATE

DIST 1 TH 169 MHD BR NO 69014 AT WIBBING — EXISTING HWY SEP 200 FT — BUILT 61
CONT SEC 6934 SEGMENT 130 FAP EXPRESSWAY — RDWAY 60 FT, SDWKS NONE 20.0 VERT CLR LOAD T
PROJ ADT 10,400 PLACEMENT-SQUARE
PRESENT STRUCTURE ADEQUATE