

The Role of Time and Money as Related to Construction Schedules

WILLIAM B. BIDELL

Many highway and road building jurisdictions, not many years ago, would award a contract on relatively short notice without having prepared all the necessary pre-contract engineering requirements which would insure reasonable bids and a proper job. Indeed in some cases the line was being set and right-of-way cleared literally just ahead of the contractor. Operations of this nature made it extremely difficult to exercise any reasonable control over expenditures or to forecast funds that would be required. With the advent of needs studies and the recognition of the tremendous task ahead, it was quickly realized that a more orderly and logical approach to what contracts were to be awarded, and when, was required if the needs were to be met systematically and at the least possible cost.

LEAD TIME

Today, before a letting date for a contract can be determined there are many functions that must be performed, such as advance planning, preparation of detailed design and specifications, and acquisition of right-of-way. Sufficient time must be allowed for advance planning, which does not include program planning, but the group of more general and preliminary studies that precedes the detailed design stage of a specific project. In many cases origin-destination surveys must be carried out together with cost-benefit analyses to determine the general location of a new route. In other cases, studies on a regional basis must be initiated and completed to ascertain the impact on the entire region of a new highway. Functional plans must then be developed, which involves aerial surveys, determination of more detailed location, and preparation of functional drawings. Frequently, intensive liaison is required with other road jurisdictions and municipalities which the proposal will seriously affect to finalize all functional aspects of the project. It may also become necessary to hold public meetings in order to explain the reasons and benefits of the project proposed. If controlled-access highways are involved most likely road closings will be required entailing time consuming preparations for board hearings. Occasionally in the preparation of the functional aspects of a project it is learned that a railway is about to be abandoned, which may delay the completion of functional designs until the necessary procedures that the railway company must carry out in abandoning the line are carried out.

At least two years should be allowed for the advance planning process. It is true that many projects will not be as involved as indicated, thus not requiring as much time. However, much of this apparent surplus time is consumed by unforeseen problems uncovered by preliminary soil, bridge and property investigations being carried out during the preparation of functional design which frequently necessitates revisions of a significant nature.

Sufficient time must also be allowed for the preparation of detailed design and specifications together with a final estimate of cost of a project. This involves field investigations and data requirements, detailed soil surveys, analysis and reports, and structure design. Very frequently discussions must be held with municipal officials and agreements signed with respect to cost sharing, drainage requirements and utility problems. At times detailed soil investigations will uncover problems which were not evident following preliminary studies and which may drastically change location resulting in a substantial delay. At least 9 months to one year should be allowed for the preparation of detailed plans.

Advance acquisition of right-of-way involves two distinct functions of pre-appraisal and negotiation. Pre-appraisal consists of establishing ownership interests and property boundaries, gathering and assessing data regarding the general area and finally, estimating the compensation due to each property owner. The negotiation function is not a standardized procedure and it is difficult to estimate accurately the time likely to be required to complete. It is therefore necessary to recognize this fact, and to allow sufficient time to take care of all delays and unforeseen difficulties.

The ideal situation would be to allow a period of at least two years between the issuance of a property request and the commencement of construction. Such an extended period of time would allow for public meetings if required; it would tend to eliminate land grabbing and the resultant increases in land values; it would avoid possible construction delays and the resultant hurried buying at the last moment; it would provide ample time to relocate buildings and to allow owners to re-establish themselves without undue hardships; and it would allow time to consult with municipalities and to make the necessary arrangements for utility moving.

Therefore, the time involved beginning with advance planning may vary from three years to four years, depending on the complexity of the problem. If approximate letting dates for projects could be established for three years in advance this would provide enough time for the required functions to be carried out, irrespective of the degree of difficulty of the problem. It would not be important to establish letting dates beyond that time, other than the year itself in which a project is programmed.

There is, however, a significant weakness in this and that is the acquisition of right-of-way would be completed immediately before the advertisement for tenders. In the case of rehabilitation projects, this does not give any time for utilities or buildings to be moved before the contractor is ready to begin; this in many cases forms the basis for claims. It would be much more desirable to have the utilities moved and possibly the necessary clearing and fencing done a year or so in advance of the award of a contract so that a contractor will not encounter any obstacles or delay. This would also give the utility companies a better opportunity to plan their work.

The implication here is to have approximate letting dates planned for four years in advance, and also that in any one year the program would consist of contract awards for those projects scheduled for that year plus right-of-way acquisition, utility moving, clearing and fencing for those projects slated for contract awards the following year.

FLOW OF CASH

In scheduling letting dates so far in advance it is essential that it is known, to a reasonable degree of accuracy, what funds will be available at any time in that period, and how and at what rate they will be expended. To illustrate one major difficulty with respect to the availability of funds at any time in the four year period, in Ontario it is not known for certain what capital funds will be at the disposal of the highway department for any one fiscal year until four or five months prior to the beginning of that year, as the appropriation or vote of the legislature is not passed until that time. This is quite an unstable position as it involves assumptions beyond the first year in the four year period being considered based on guess work as to the funds that may be available. This obviously seriously affects the scheduling of the letting of future contracts.

Where the inflow of cash is based on appropriations from the legislature, it would be highly desirable to have funds voted for at least three, and preferably four, years in advance, so as to be able properly to plan advance programs and schedules.

With respect to the outflow of cash, one of the formidable problems of scheduling future letting dates, is the one of estimating contract costs and construction progress. Detailed estimates are only available for those projects to be proceeded with in the year immediately following, or at the most an additional year, while for those in the following years no detailed estimates are available. One must rely on past experience on past contracts of a similar nature. This may lead to underestimating significant proportions. Furthermore, it could be said that the longer it takes to prepare detailed design the more likely more work will be added to the project as time goes on, which again increases the cost. It would be prudent therefore, when arriving at a preliminary

cost estimate for a project to apply a factor of perhaps 1.10 to 1.15 to take care of these possibilities. In addition rising construction costs and inflationary tendencies must be taken into account.

It is also important to maintain a reserve of funds for each of the fiscal years to accommodate emergency contracts which have not been included in the advance planning of the letting schedule. For example, an extremely wet fall followed by a severe winter will deteriorate some road surfaces to a point beyond repair. The reserve will also serve to accommodate project additions to the schedule, which sometimes occur and are beyond the control of those planning the work. Allowance in the reserve should also be made for unforeseen overruns in contracts under way, which can amount up to 2 to 3 percent of the award value. A relatively recent development in highway contracts which has aided the control of flow of money immeasurably was the introduction of the concept of prequalification of contractors and the insertion of a liquidated damages clause in the contract. Previously, many contracts were not being completed within the time limits specified. This was due to the fact that some contractors were awarded a greater number of contracts than their financial resources and equipment could handle. Consequently, the completion of many projects consumed a great deal more time than originally anticipated which made it extremely difficult to estimate construction time and expenditures in advance. With the implementation of prequalification and liquidated damages much more accurate forecasts of expenditures can now be made.

PRESENT SCHEDULING METHODS IN ONTARIO

Inflow of Cash

In Ontario highways are financed by appropriations of the legislature from the consolidated revenue fund, which includes receipts from nearly all tax sources and special fees. Theoretically then, there is no direct connection between budgeted appropriations or expenditures and highway-user tax receipts. Practically, the legislature tends to appropriate funds somewhat in proportion to the funds received from special highway taxes, such as on gasoline and motor vehicles. What has actually happened over the years, is that there have been notable exceptions when appropriations were much less than the special revenues, and conversely, when annual highway budgets exceeded special highway tax revenues. However, in total, expenditures up until 1955 have equaled roughly the total revenue in that period. During the past five years expenditures have risen considerably in excess of revenues. This development was a direct result of the highway needs study which clearly showed that if the backlog were to be eliminated within a reasonable length of time, a sharp rise in expenditures was necessary. This is being accomplished by the concept that credit financing plus higher revenues from highway users will provide sufficient funds to allow acceleration of the highway construction program to take place, and also that the benefits derived from such a program will offset much of the cost involved. Once the funds are appropriated by the legislature for the one year ahead, the objective is of course to schedule construction so that expenditures on highway construction do not exceed that amount.

Outflow of Cash

Figure 1 shows a typical statement of capital expenditures for one fiscal year. The first item that must be taken care of is the commitments or "carry-over" from the preceding year or years. The amount shown represents the difference between the contract award values and the payments already made to the beginning of the year under consideration. It should be noted that a 100 percent expenditure of the carry-over is not expected during that year.

The next expenditure is that to be expected on new contracts to be awarded during the year. With the construction season from May to November, an expenditure of from 35 to 40 percent of the total value of awards during the year is generally expected. More specifically the expenditure shown is arrived at by the use of expenditure charts (Figs. 10-18) which will be discussed subsequently.

The bulk of work shown under miscellaneous construction is for projects to be done in cities and towns. This is work carried out under construction agreements on exist-

CAPITAL PROGRAM 1960-1961

FINANCIAL SUMMARY

ROAD CONSTRUCTION	Estimated Total Value	Proposed Expenditure
CARRY-OVER WORK		
Construction Division Capital Contracts	65,573,000	55,900,000
Maintenance Division Capital Projects	<u>827,000</u>	<u>827,000</u>
Sub-Total	66,400,000	56,727,000
PROPOSED NEW WORK		
Construction Division Capital Projects	104,243,000	35,585,000
Maintenance Division Capital Projects	<u>4,800,000</u>	<u>4,200,000</u>
Sub-Total	109,043,000	39,785,000
MISCELLANEOUS CONSTRUCTION		
CARRY-OVER WORK		
Construction Agreements (Normal)	1,764,000	1,764,000
Construction Agreements (Special)	2,000,000	2,000,000
Contract Post-Award Revisions	3,500,000	3,500,000
Preliminary Project Work	4,441,000	2,000,000
Miscellaneous Construction Division Projects	<u>422,000</u>	<u>422,000</u>
Sub-Total	12,127,000	9,686,000
PROPOSED NEW WORK		
Construction Agreements (Normal)	4,000,000	2,000,000
Construction Agreements (Special)	4,676,000	2,535,000
Contract Post-Award Revisions	2,000,000	1,500,000
Construction Overhead	1,271,000	1,271,000
Railway Grade-Crossing Protection	50,000	50,000
Municipal and Award Drains	100,000	100,000
Invitation Bids	<u>500,000</u>	<u>500,000</u>
Sub-Total	12,597,000	7,956,000
ENGINEERING (HEAD OFFICE)		
Planning & Design, Audit, Checking, Materials & Research Section (All Proposed New Work)	9,500,000	9,500,000
SERVICES		
Land Surveys, Property Purchase, Buildings, Bridge & Steel Stockpile (All Proposed New Work)	16,665,000	16,665,000
TOTAL	<u>226,332,000</u>	<u>140,319,000</u>
REVIEW		
CARRY-OVER WORK	78,527,000	66,413,000
PROPOSED NEW WORK	121,640,000	47,741,000
ENGINEERING & SERVICES	<u>26,165,000</u>	<u>26,165,000</u>
TOTAL	226,332,000	140,319,000

Figure 1.

ing streets or new routes designated as connecting routes of King's Highways, whereby the municipality carries out the work and the department contributes 50 to 100 percent of the cost.

Contract post-award revisions are necessitated by unforeseen developments in the course of construction. This item is in effect a contingency allowance based on experience. Preliminary project work consists of the moving of utilities and ordering of reinforcing and structural steel which must be carried out in advance of the contractor's operations. Construction overhead consists of salaries of certain regional and district personnel (engineering supervisors and staff) whose general services cannot readily be assessed against the particular projects that they deal with.

Engineering (head office) consists of planning investigations, engineering surveys, designing, estimating, checking and auditing.

Services consist of land-surveying acquisition of right-of-way, stock piling of reinforcing steel and emergency bridge parts such as bailey panels and construction of district buildings.

Insofar as the flow of money to finance this program is concerned the monthly pattern of expenditures can be readily seen (Fig. 2). For example, for the month of September approximately 12 percent of the year's total will be spent during that month and also that by the end of September roughly one-half of the year's total will have been expended from the beginning of the fiscal year. This information is submitted to the Treasury Department in advance so that those responsible know approximately what to expect from month to month.

Lead Time

Pre-contract engineering consists of six individual sections preparing their part of the data based on information received. Each section receives data from the preceding section, adds its findings and forwards the more complete data to the next section.

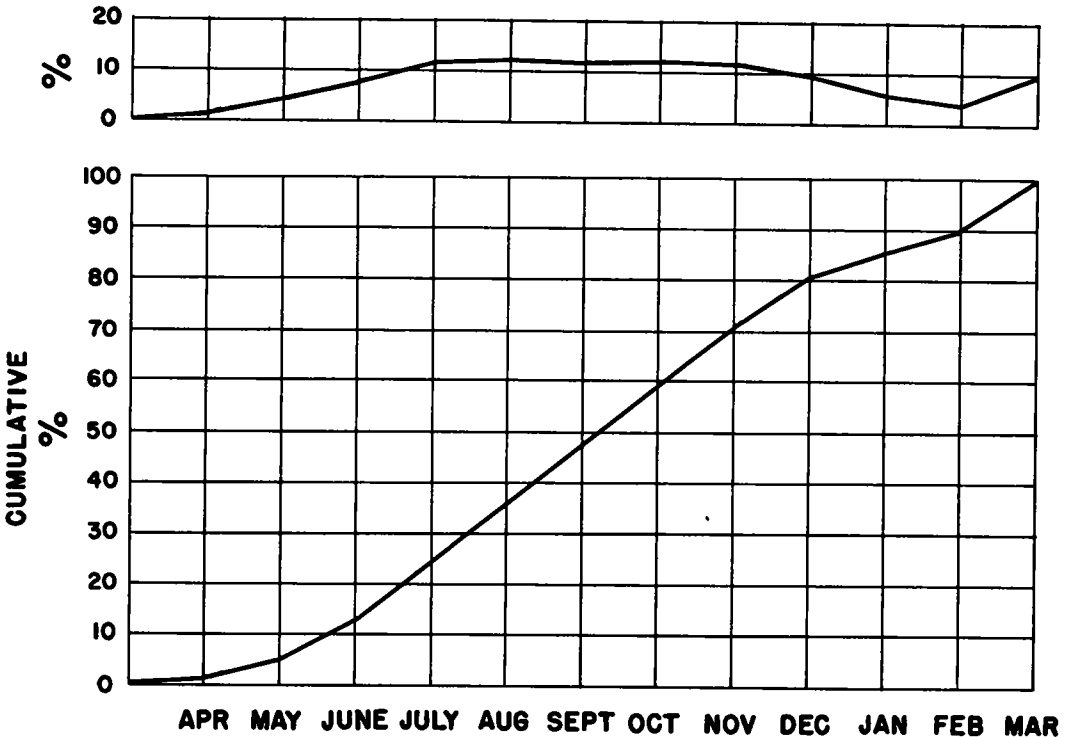


Figure 2. Typical construction expenditures.

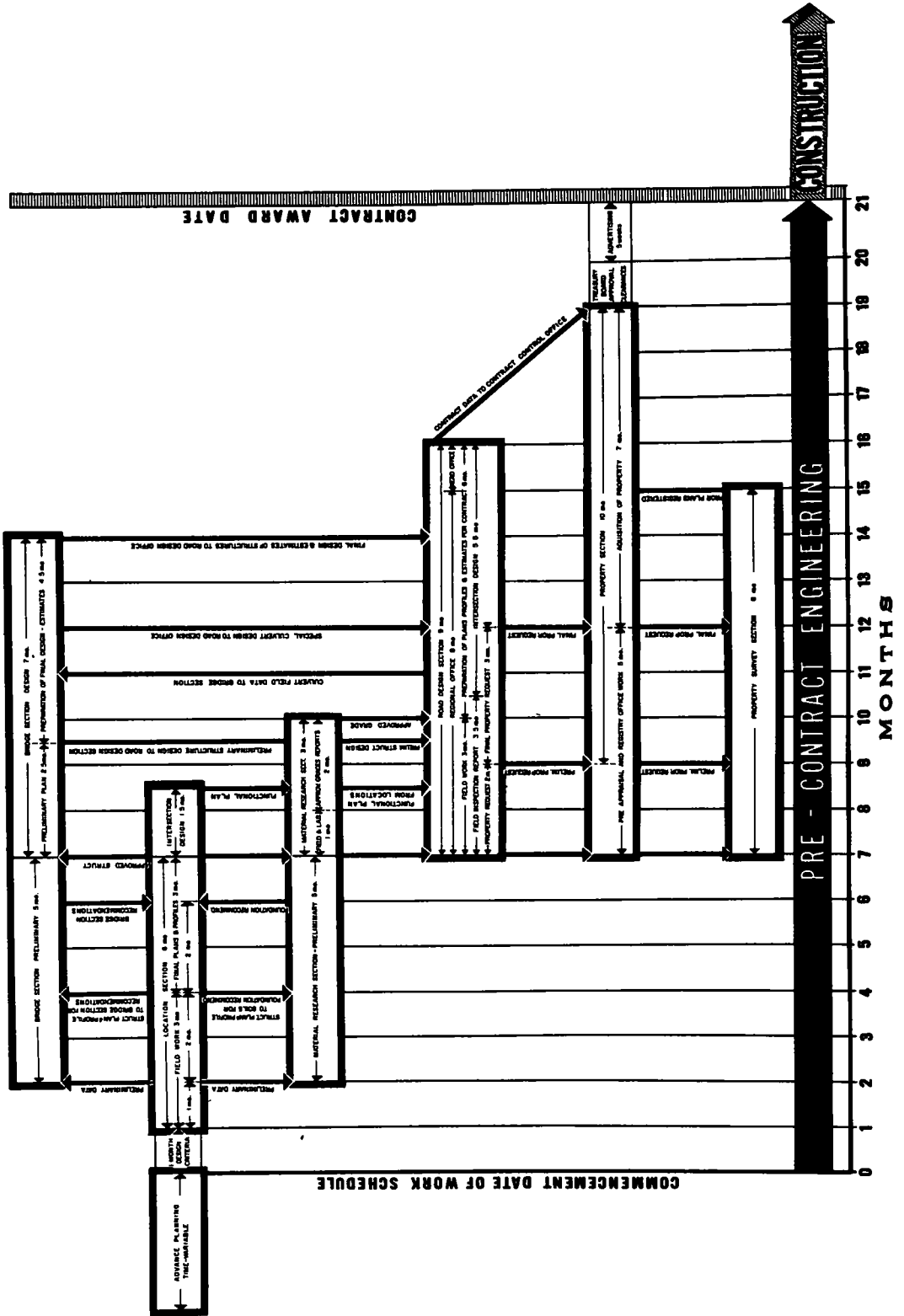


Figure 3. Work-time chart.

APPROVED PRE-CONTRACT ENGINEERING SCHEDULE						REVISIONS			
						January 20, 1980.			
WORK SCHEDULE No. 21									
W P	Dist	HWY No	Type of Work	Name and Location	Final Design Criteria	Location Section	Final Bridge Design	Material and Research Section	R D O.
41-59	8	401	Struct.	New Hwy. 38 Interch	Mar 4/56	Sept 2/9	Nov 18/9	Mar 23/60	June 8/60
67-58	10	62	Struct	Bonnechere Ri Tramore	"	"	"	"	"
188-59	6	2	GDGB Pav.	Pickering to Metro East Limits 5 5 miles	"	"	"	N A	"
35-56 112-58	3	8 CAH	GD & S	Freeport Div and Lake Erie and Northern Rwy Structures	"	"	"	Mar 23/60	"
221-59	11	60	Struct.	Smoke Crk. (20 mi. E. of Jct. of Hwy 35 and 60)	"	"	"	"	"
102-A-58	11	60	GB Pav.	Algonquin Park W Gate E. to Smoke Cr 7 0 mi	"	"	"	N A	"
247-59	5	92	Struct	Nottawasaga Ri. (Wasaga Beach)	"	Oct 14/9	"	Mar 23/60	"

Figure 4.

or sections. The function of the work schedule is to coordinate efficiently this flow of work by developing and controlling a schedule of dates as to when the information must be completed and forwarded to the respective sections. Figures 3 through 5 show the point of beginning and completion of each phase of the work and how the work of the various sections dovetails.

Advance Planning.—Prior to the preparation of location and functional plans, a preliminary design criteria sheet is issued by the program section suggesting the general design requirements, which is sent to the various sections heads and appropriate district engineer for their criticisms or approval, and comments. Based on the information received, final design criteria are produced in one month from the time this "reaction" is received. This procedure works out quite well if the project under consideration consists primarily of rehabilitation of an existing road. However, if multi-lane requirements or a new location are required which may involve the necessity of carrying out detailed studies, origin-destination surveys, and area studies, then the system breaks down and the project must be delayed to provide time to carry out these studies. The problem is not due to the scheduling procedure but to the fact that the future program is not available for more than two years in advance. However, by the end of this year a 3-year advance program will be available which will provide approximately one year for these studies to be carried out if necessary.

Location Section.—One month after the final design criteria have been issued this section forwards preliminary functional plans, consisting primarily of line and grade, to the bridge and materials and research sections for their consideration. The purpose of this is to advise the location section of any serious difficulties which may be encountered with respect to suggested bridge locations and soils problems. This move, in many instances, cuts down waste effort on the part of the location section. In the case of grading projects, six months after receipt of the final design criteria this section must produce complete functional plans for distribution to the other sections.

In the case of structure projects, three months after receipt of the final design criteria, the suggested alignment is forwarded to the bridge section for their recommendations. At the same time plans are forwarded to the materials and research section for recommendation as to location and for a foundations report. If it is anticipated that serious problems will be encountered with respect to property acquisition, these plans are also sent to the property section for study and suggestions.

Recommendations are received from these sections within two months. At this time

if the structure under consideration involves a railway crossing, a plan is forwarded to the railway company for their present and future requirements. One month later a final site plan is issued to the bridge section.

Bridge Section. — Although the actual design does not start until the approved site plan is received, considerable preparatory work can be accomplished in the five months between receiving the preliminary plans and profiles. The site plan field inspection

REVISION March 1, 1960

TENTATIVE SCHEDULE OF PRE-CONTRACT ENGINEERING

WORK SCHEDULE NO. 21

FOR ROAD DESIGN SECTION

1. Design Criteria	- Mar. 4 /59	9. R. D. O. to E. C. C.	-Dec. 30/59
2. Location	- Sept. 2 /59	10. E. C. C. Complete	-Jan. 13/60
3. Channelization	- Oct. 14 /59	11. Clvt. Data to Bridge	-Jan. 13/60
4. Prelim. Property	- Nov. 4 /59	12. Property Req. (Final)	-Jan. 20/60
5. Bridge (Prelim)	- Nov. 11 /59	13. Splicing Group	-Mar. 30/60
6. Soils	- Nov. 18 /59	14. Bridge (Final)	-Mar. 23/60
7. Field Staff	- Nov. 25 /59	15. R. R. Board Estimate	-Mar. 30/60
8. Field Insp. Report	- Dec. 16 /59	16. Regional Office	-May 4/60

17. R. D. O. June 8/60

W. P. No.	Dist.	Hwy.	Work of	Location
41-59	8	401	Struct.	New Hwy. 38 Interch.
67-58	10	62	Struct.	Bonnechere Ri. Tramore.
188-59	6	2	GDGB Pav.	Pickering to Metro East Limits 5.5 mi.
35-56 112-58	3	8 CAH	GD & S	Freeport Div. and Lake Erie and Northern Rwy. Structs.
221-59	11	60	Struct.	Smoke Crk. (20 mi. E. of Jct. of Hwy. 35 and 60).
102A-58	11	60	GB Pav.	Algonquin Park W. Gate E. to Smoke Cr. 7.0 mi.
247-59	5	92	Struct.	Nottawasaga Ri. (Wasaga Beach).

Figure 5.

Scheduling Section,
Date July 29/60.

MEMORANDUM TO

Mr. T. C. Muir,
Contract Control Engineer,
Room 2630.

RE ADVANCE NOTICE FOR CALLING TENDERS

Cont. No. 60-192 W P. No. 35-56
112-58 Dist No. 3Hwy. No. 8 C. A. H. Type of Work Grading Culverts & StructureLocation Freeport Diversion and L. E. N. Diversion 2.5 miles.Total Estimated Cost \$ 650,000Information Date Aug. 24/60.Advertising Date Sept. 7/60.Tender Closing Date Oct. 12/60. For Tender Opening No. 28SCHEDULING SUPERVISOR

Copies To

Road Design Section
Material Laboratory
District Engineer
Construction Engineer
Property SectionBridge Section
Reproduction Section
Trans Canada Section
Special Liaison Section

THIS FORM TO BE RETAINED BY SECTION.

Figure 6.

would be included in this work to determine if the site is suitable, type and span of the proposed structure, costs, etc., all of which will be used in making up the recommendations to the location section. Any recommendations for change of alignment can be made early enough so that the location section will not be late in issuing the site plan. This time is also used to determine if the stream is navigable and if so to prepare all data required for agreement under the National Navigable Waters Act.

Seven months is allowed for the design of a structure. Two and a half months after receiving the site plan, the bridge section forwards a preliminary design to the road design section and in four and a half months the final design.

MEMORANDUM TO:

Mr. R. Strain,
Scheduling Supervisor,
Parliament Buildings.

Scheduling Section
Date July 29/60

RE: CLEARANCE NOTICE

Cont. No. 60-192 W.P. No. 35-58
112-58
Dist. No. 3 Hwy. 8 CA Type Grading Drainage and
Structure
Location Freeport Diversion and L. E. N. Rly.

From the attached "Advance Notice" I have noted that the above Contract has been scheduled to be called for Tender as indicated.

For your information I indicate by my signature opposite the applicable item that all the pertinent information and requirements will be available and fulfilled by the proposed information date shown on the attached "Advance Notice".

ITEM	SIGNATURE	SECTION
1. Strip Maps		Materials
2. Bridge D4 & Drawings (Struct. Steel)		Bridge
3. Property Acquired		Property
4. R.D.O. Cont. Data & Drawings		Road Design
5. Contract Prints		Reproduction
6. Rwy. Board Approval		Spec. Liaison
7. TCH Approval		Trans Canada
8. Navigable Water Clearance		Bridge
9. Prior Contract Clearance		Cont. Control
10. Staff Availability		Cont. Control
11. TBC Approval		Cont. Control

Remarks:

IF YOUR PARTICULAR ITEM FOR THIS CONTRACT DOES NOT REQUIRE YOUR INFORMATION OR REQUIREMENTS PLEASE SIGNIFY N/A.

1st COPY - TO BE RETURNED TO SCHEDULING SECTION AS SOON AS POSSIBLE.
2nd COPY - TO BE RETAINED BY SECTION.

Figure 7.

Materials and Research Section. — The same preliminary time is available to this section. It is also used for the investigation of structure sites and foundation problems. An attempt is made to foresee any major soil problems which may affect a major part of the location of an entire project.

In Ontario field data can be gathered only between the first of May and the first of November. With an around-the-year schedule, the location section would be turning out final data during the winter months which this section's field staff would be unable to use until after May first. However, there are sufficient data in the preliminary plans and profiles so that field work can be completed before fall. Therefore when the

DEPARTMENT OF HIGHWAYS							TOTAL		FINANCIAL SUMMARY (CAPITAL CONTRACTS ONLY)		
Form FC-BA-1 Rev											
TREASURY BOARD CERTIFICATE											
DATE August 15		NO. 103			PAGE NO		OF				
Contract No	W P Number	District	Highway No	Description of Work	Location	Total Estimated Cost & (Cost per Mile)	Estimated Current Year's Expenditure	Total per prev cert	Total Estimated Cost	Estimated Current Year Expenditure	
210	41-59	8	401	Grading Paving & Structure	New Hwy 38	350,000	160,000	-	65,362,733	33,650,000	
213	188-59	8	2	Grading Culverts & Paving	Pickering to Metro East Limits - 5 mi.	250,000	70,000	-	67,665,733	34,280,000	
192	35-59 112-59	3	8 C A H	Grading Culverts & Structure	Freeport Diversion & L E N Rly Ob'head 2 5 mi.	650,000 (200,000)	150,000	-	236,451	60,000	
214	102-58-1 221-59	11	60	Grading Culverts Granular Base, Structure & Paving	Algonquin Park Gates to Smoke Crk includ Structure at Smoke Crk. 7 0 miles	600,000 (80,000)	90,000	-	67,409,282	34,220,000	
215	247-59	5	92	Structure	Nottawasaga River at Wasaga	453,000	160,000	-	<u>APPROVAL</u>		
TOTAL						2,303,000	630,000				
CERTIFICATION											
I hereby certify that this work is necessary and that the estimated cost has been carefully calculated			I hereby certify that sufficient construction personnel is available to supervise this (these) Contract (s)			I hereby certify that the Department has funds available to meet the estimated expenditures on this(these) contract (s) within the current fiscal year					
DIRECTOR OF PLANNING & DESIGN			MANAGER OF OPERATIONS			FINANCIAL COMPTROLLER					
							DEPUTY MINISTER OF HIGHWAYS				
							MINISTER OF HIGHWAYS				
							PROVINCIAL TREASURER				

Figure 8.

location section finishes its approved plans and profiles the materials and research section can add information and complete all work on schedule even though this may be in the middle of winter. The section is given three months from receipt of approved plans and profiles from the location section to forward its data to the road design section.

Road Design Section.—The function of this section is to utilize all data provided by the other sections (excepting property and property survey sections) at various intervals throughout the nine months allowed, for the preparation of the necessary design, specifications, and estimates. As these intervals can be as short as two weeks, expediting is very important in this section to see that all data are received on time. Commencement date for this section is the receipt of approved functional plans from the location section. Two weeks before the completion of field work, the bridge section forwards a preliminary design of any structures that may be included in the project, so that all the necessary field work may be completed in the allotted three months. In addition the project engineer, with the district or construction engineer, will make a field inspection trip and meet with municipal authorities, if they are involved, to ascertain their requirements. The project engineer report is made final three weeks after the completion of the field work. At this point the approved grade and recommendations are received from the materials and research section so that the work of computing quantities can proceed. Two months after the commencement date a preliminary property request showing property obviously required is forwarded to the property and property survey section. Three months later a final property request is forwarded. Two months prior to completion date, final designs and estimates are received from the bridge section. The regional office, which has performed all of the foregoing, now has one month to complete and forward to the head office all plans and estimates required for the contract.

If the project is a railway overhead, in which case a subsidy is received, the regional office will forward, through the special services liaison engineer, plans and estimates to the Board of Transport commissioners for approval. This is forwarded one week before information is sent to the head office.

Property Section. — Two months after the road design section begins its work a preliminary property request is forwarded to the property section. This enables such work as registry office searches and property appraisals to be done prior to the receipt of final requirements. All property should be acquired seven months after the final property request is received.

The property section's completion date extends three months beyond the completion of all pre-contract engineering data. It has been found, that all the time possible should be allowed for property acquisition in order to maintain good public relations.

Scheduling Section,
Date Aug. 25/60.

MEMORANDUM TO:

Mr. T. C. Muir,
Contract Control Engineer,
Room 2630.

RE: FINAL NOTICE FOR CALLING TENDERS

Cont. No. 60-192 W.P. No. 35-56 Dist. No. _____
 Hwy. No. 8 C. A. H. Type of Work Grading, Drainage and Structure
 Location Freeport Diversion and L. E. N. Rly. - 2.5 miles.

This is to advise that all necessary clearances for calling tenders have been received and are listed below.

	DATE	REMARKS
1. Strip Maps	<u>Aug. 1/60</u>	Board Order #100248
2. Bridge Cont. Data (S.S.)	<u>Aug. 3/60</u>	<u>Cost Participation</u>
3. Property	<u>Aug. 4/60</u>	
4. RDO Cont. Data	<u>Aug. 8/60</u>	80% by Rly. Bd. - \$ 161,800
5. Reproductions	<u>Aug. 8/60</u>	5% by L. E. N. Rly. \$ 10,100
6. Rwy. Board Approval	<u>Aug. 4/60</u>	
7. TCH Approval	<u>N. A.</u>	
8. Navigable Water	<u>N. A.</u>	
9. Prior Cont. Clearance	<u>Aug. 15/60</u>	
10. Staff Availability	<u>Aug. 21/60</u>	
11. TBC Approval	<u>Aug. 3/60</u>	

SCHEDULING SUPERVISOR

Figure 9.

Scheduling Section & Contract Control

When the road design section has completed the estimate for a contract it is forwarded to the scheduling section for a contract number. All pertinent data are filled in on an "Advance Notice for Calling Tender" (Fig. 6) which is forwarded to the contract control engineer. At the same time the scheduling section fills out a Clearance Notice (Fig. 7) and forwards it along with a copy of the Advance Notice to all 9 sections listed. Clearance from sections will indicate the following:—

1. Road design: all plans & estimates will be complete;
2. Materials and research: strip maps will be available;
3. District engineer: staff will be available;
4. Construction engineer: staff will be available;
5. Property section: all property will be acquired;
6. Bridge section: all structural steel design plans and estimates will be complete and clearance under the Navigable Waters Act will be obtained;
7. Special liaison section: Railway Board approval and any clearances from the railway company itself will be obtained;
8. Trans-Canada liaison engineer: approval will have been obtained from the federal trans-Canada highway engineer; and
9. Contract control engineer: completion of former grading work or abutments will coincide with the commencement of the impending paving or structural steel contract.

When the contract control engineer receives the "Advance Notice" he will fill in all required data on the Treasury Board Certificate (Fig. 8) and circulate for approvals.

Date <u>March 2/60</u>		APPROVED SCHEDULE FOR 1960 - 61				Page <u>1</u> of <u>1</u>	
PROGRAM OF CONSTRUCTION							
TENDER OPENING No. <u>28</u>							
WP No.	DIST	HWY No.	Type of work	LOCATION	Date of		CONT No.
					Advert	Award	
41-59	8	401	G, GB, Pav & Struct	New Hwy 38 Interchange	Sept 9/60	Oct 12/60	60-210
188-59	6	2	G D, GB & Pav	Pickering to Metro E. Limits- 5 5 miles	Sept. 7/60	Oct 12/60	60-213
35-56 112-58	3	8 CAH	G D & Struct	Freeport Diversion & L E N Rly O'Head 2 5 mi	Sept. 7/60	Oct 12/60	60-192
102-58-1 221-59	11	60	G, D, GB, Pav. & Struct	Algonquin Park Gates to Smoke Creek including Struct. at Smoke Crk. - 7 0 miles	Sept. 7/60.	Oct. 12/60	60-214
247-59	5	92	Struct	Nottawasaga River Bridge at Wasaga	Sept 7/60	Oct. 12/60.	60-215

Figure 10.

On receiving these certifications, the contract control engineer forwards the certificate to the Minister and Deputy Minister for their approval who in turn forward it to the Treasury Board where the provincial treasurer will sign for the Board's approval and return it to the contract control engineer.

When the scheduling section receives all clearances a "Final Notice for Calling Tenders" (Fig. 9) is forwarded to the contract control engineer who advises that all clearances have been received and therefore tenders can be called.

SCHEDULING OF AWARDS AND DETERMINATION OF CONSTRUCTION EXPENDITURES

Scheduling of Contract Awards

In establishing a schedule of award the following factors are considered:

PROPOSED SCHEDULE OF
TENDER CALLS
FOR CAPITAL CONSTRUCTION CONTRACTS
DURING MONTHS OF JULY & AUGUST 1960

GENERAL

<u>Type of Contract</u>	<u>Month of Advertising</u>		<u>Total</u>
	<u>July</u>	<u>August</u>	
Grading	4	3	7
Grading and Paving	5	10	15
Hot Mix Paving	9	3	9
Structure	2	7	6
Structural Steel	4	2	1
Miscellaneous	0	1	1
	24	26	50

DETAIL

Group #1 - Grading

<u>District</u>	<u>Hwy.</u>	<u>Location</u>	<u>Mileage</u>	<u>Month of Advertising</u>
Chatham	Dev. Rd. 471	Alvinston Westerly.	5.7	July
Huntsville	69 TC	Parry Sound By-Pass including Sequin R1. Struct.	3.5	July
Fort William	17 TC	20 0 miles East of Nipigon to 2.0 mi. W. of Cavers including the Cypress River Bridge.	11.0	August
Kenora	17 TC	19 5 mi. to 30.0 miles East of Hwy. #17.	11.5	August

Figure 11.

1. The primary concern is to schedule the awards of contracts so as not to exceed the amount of money available for the year.
2. The awards should be so scheduled so as to conform as closely as possible with the priority assigned to each project.
3. Every attempt is made to arrange the award of a contract whose progress after award is dependent on a contract under way from the previous year or years so that no delay would occur. If this is not done then the door is being left open for claims. (For

EXPENDITURE CHART
FOR
GRADING CONTRACTS (G,C,GB) UP TO \$ 300,000

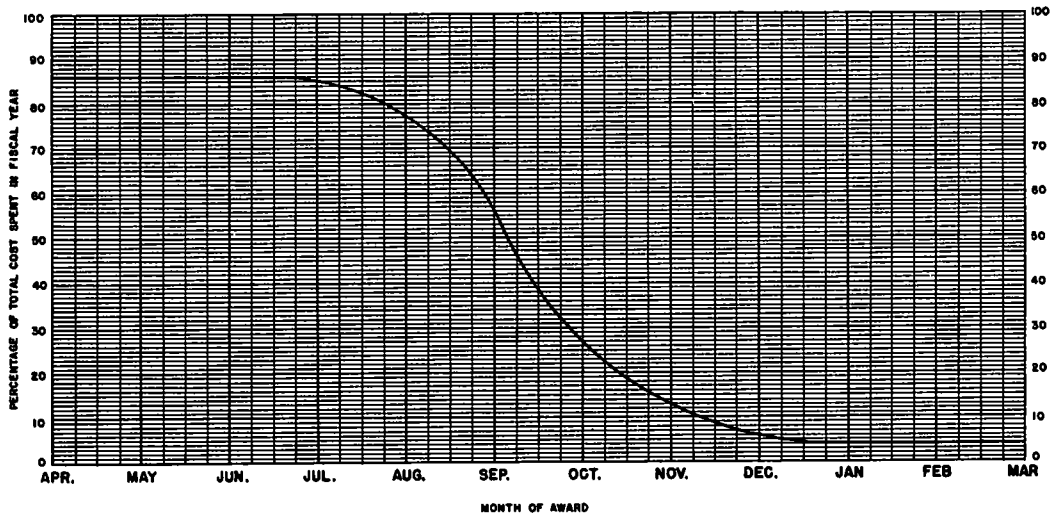


Figure 12.

FOR
GRADING CONTRACTS (G, C, GB) \$ 300,000 to \$700,000

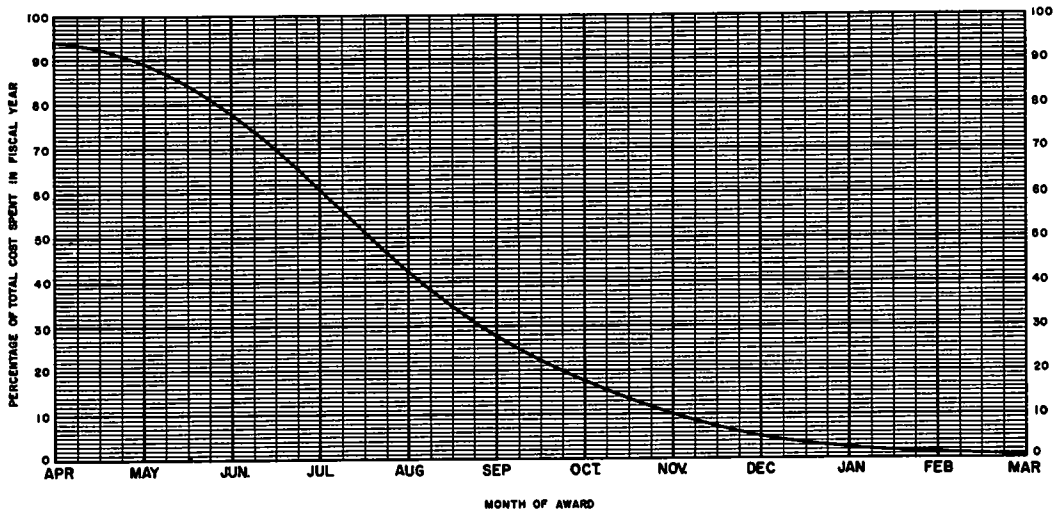


Figure 13.

example, a paving contract following a grading project for the same section of highway; or a grading project in which the contractor's mobility is dependent on a key structure being completed by a previous contractor.)

4. Due consideration must be given to distributing the work in work in each district in such a manner so as to not create an impossible situation with respect to the supervising staff.

5. In view of weather conditions in Ontario some contracts must be awarded suffi-

**EXPENDITURE CHART
FOR
GRADING CONTRACTS (G, C, GB) \$ 700,000 to \$ 1,000,000**

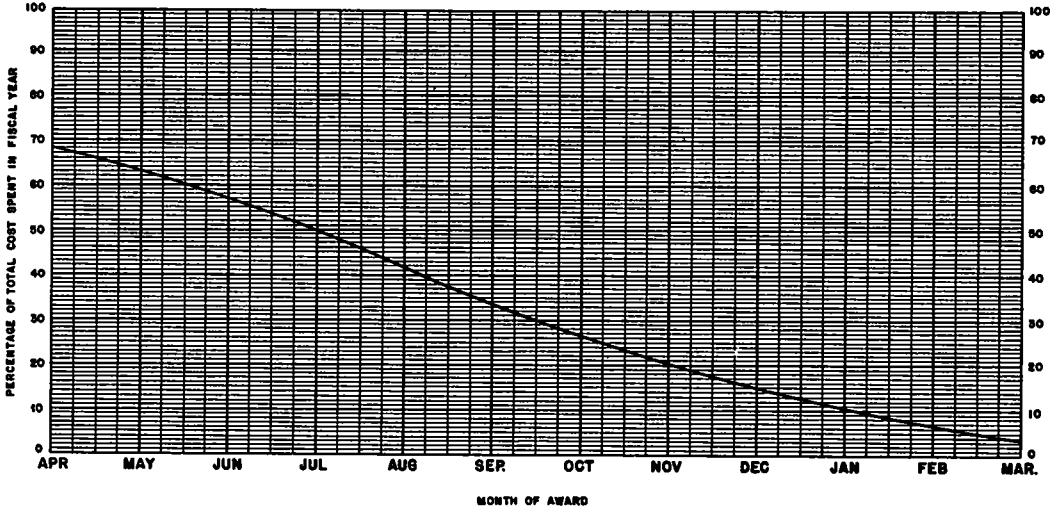


Figure 14.

**FOR
GRADING CONTRACTS (G, C, GB) OVER \$ 1,000,000**

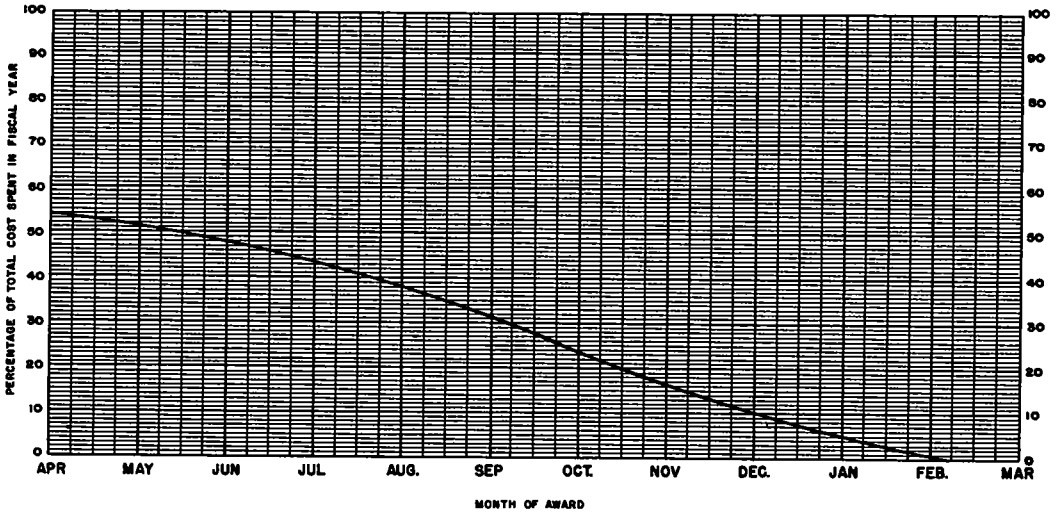


Figure 15.

ciently in advance of winter. One example is when rock excavation is a significant part of the project sufficient time must be allowed for the contractor to carry out overburden stripping operations before freeze-up. Another example is where sufficient time should be allowed for a hot mix paving contract to be completed rather than to be forced to shut down operations because of cold weather.

6. In Ontario the policy with respect to detouring traffic during construction opera-

EXPENDITURE CHART
FOR
STRUCTURE CONTRACTS UP TO \$100,000

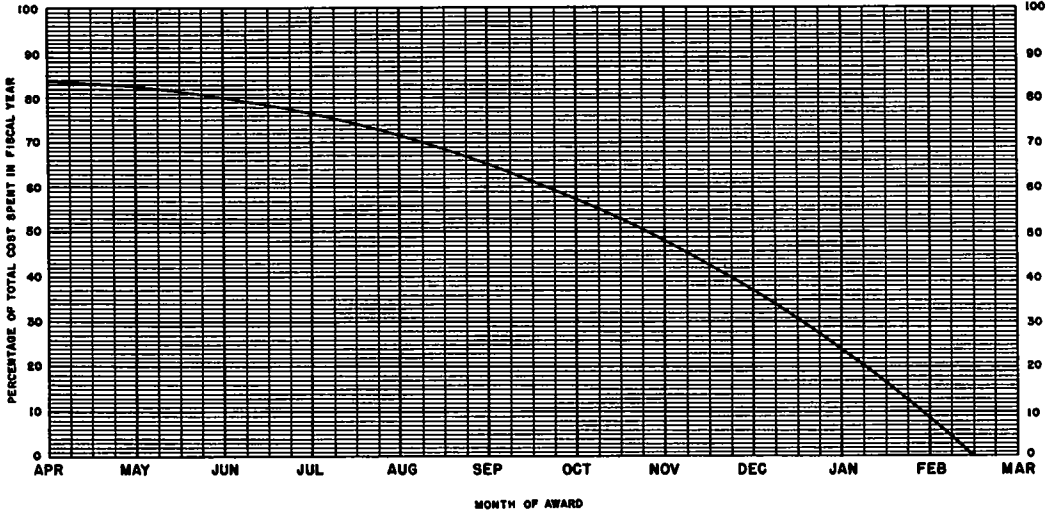


Figure 16.

FOR
STRUCTURE CONTRACTS \$100,000 to \$400,000

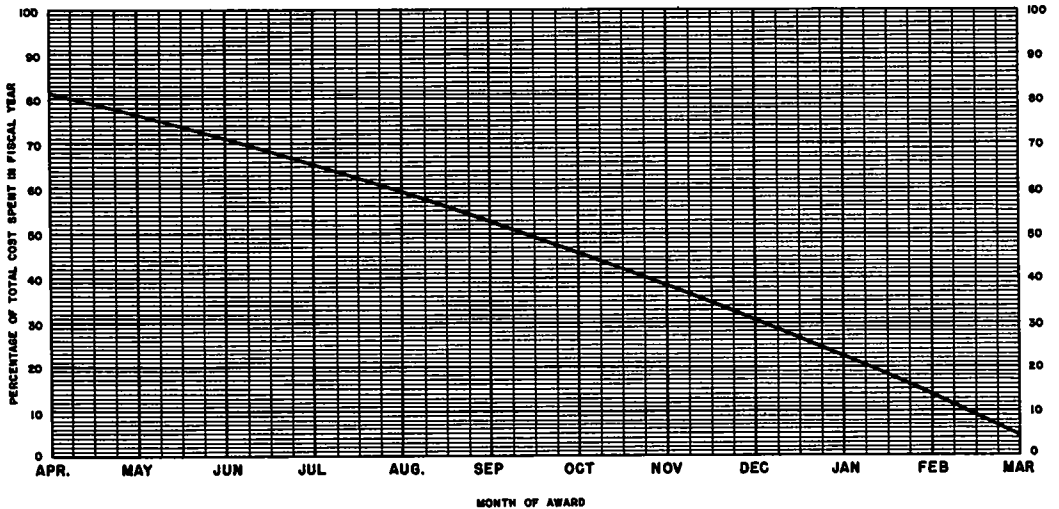


Figure 17.

tions is in the vast majority of cases such that traffic must be handled at the same time. In other words a section of highway under construction is not closed to the motoring public. In view of this, due regard must be given to avoiding long sections (2 or more contracts) of continuous construction.

7. The question of maintenance must be considered. At times, if the award of a rehabilitation project is delayed until late in the construction season, district forces would

EXPENDITURE CHART
FOR
STRUCTURE CONTRACTS OVER \$400,000

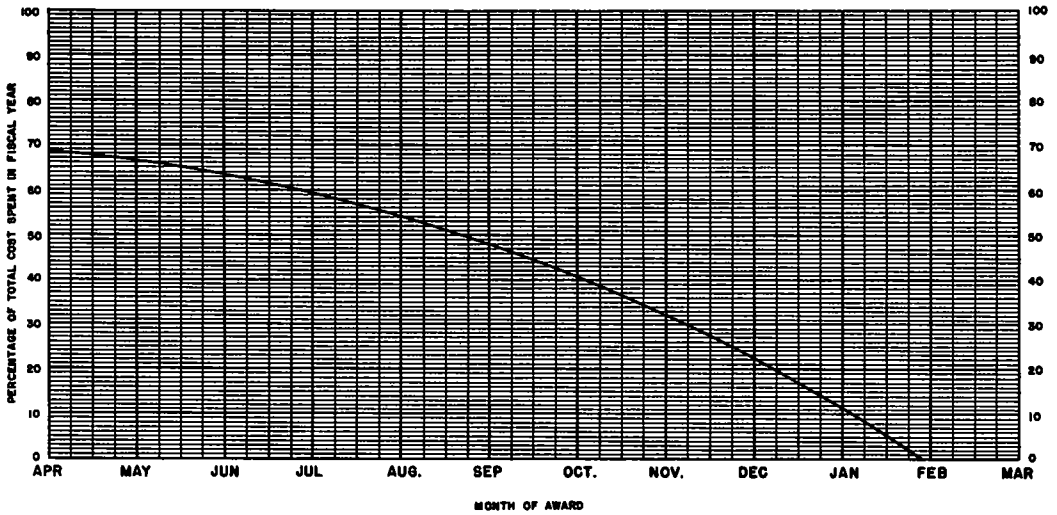


Figure 18.

FOR
HOT MIX PAVING CONTRACTS UP TO \$500,000

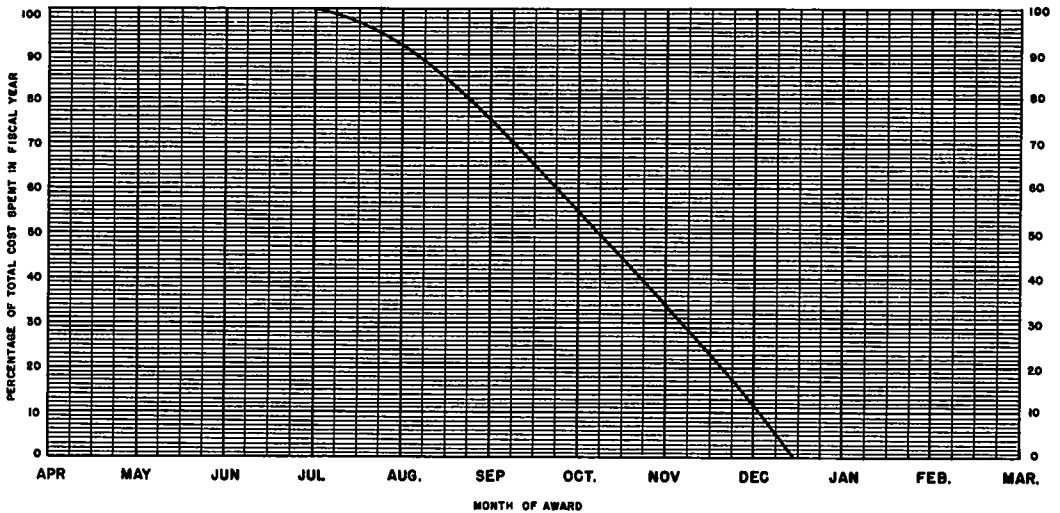


Figure 19.

have no alternative but to carry out costly maintenance measures, which are immediately wasted following the start of construction. This could be avoided by awarding the contract early in the season.

Awards of highway contracts are scheduled by "tender openings." The number of the tender opening determines on what date the call for tenders will be made and on what date the tenders will be opened (Fig. 10). Prior to the practice of prequalifica-

EXPENDITURE CHART
FOR

HOT MIX PAVING CONTRACTS OVER \$ 500,000

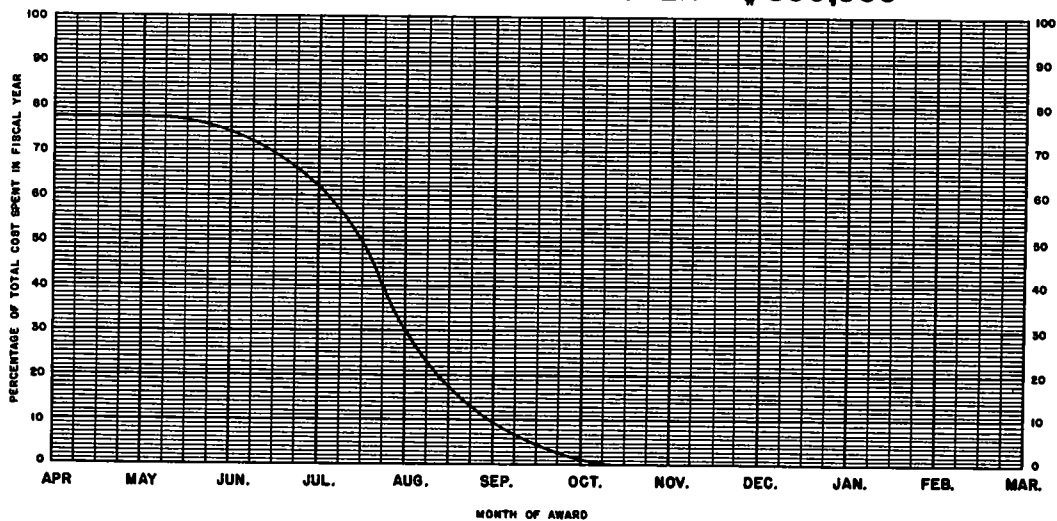


Figure 20.

tion of contractors three weeks were allowed for the preparation and submission of bids. Since prequalification five weeks has been the standard practice.

As an aid to members of the department, members of the legislature, and more significantly, to all interested contractors, a two month advance notice of what project will be called, is provided (Fig. 11). This allows an interested contractor further time to investigate general problems which may be encountered if the contract is awarded to him. It is particularly useful in cases where the call for tenders is made coincident with the first snowfall or soon after. The two months advance notice enables the prospective successful bidder to study the general aspects of the project before the ground becomes snow covered.

Determination of Construction Expenditures

In dealing with this problem there are two major divisions to be considered: (a) construction under way or "carryover," and (b) new construction.

Carryover.—The method used in determining what expenditure can be expected on contracts that are under way leans very heavily on past experience. By keeping records over several years it has been firmly established that on the average, for work started in the year previous to the one under consideration, 85 percent of the carryover value will be spent during the year being considered, and for contracts started two or more years prior to the year in question, 100 percent will be spent. Therefore, without considering each project individually, these percentages are applied to the total values of carryover thereby giving the amount that will be spent. There will, of course, be exceptions to this empirical method but the results obtained are within acceptable limits.

New Work.—In the case of new construction a graphical method (Figs. 12-20) is used to determine the expenditure to be expected. The graphs were developed by recording results since 1956 and are based on the date of award and type of contract. It should be noted that since the prequalification of contractors has been instituted in 1956 and the insertion of liquidated damages in contracts the rate of expenditure has been considerably increased, that is, construction work is significantly more rapid and more consistent time-wise than prior to prequalification.

Discussion

Bidell.—I would like to cover some of the problems that we encountered in developing construction schedules. The first major problem that Ontario faces is what money will be available for a construction program. In Ontario, funds are appropriated by the legislature out of a consolidated general revenue fund. That is, all workings of the government are financed by this one fund. I believe that there are several States operating on that same basis, for example, New Jersey and New York.

In Ontario, we only know what money will be available for the year immediately following the request for the funds. This usually is known about two or three months before the actual fiscal year starts. The fiscal year runs from April 1st to March 30th. That makes scheduling ahead three to five years extremely difficult.

For the last five years, however, we have been very fortunate in getting the money that we had anticipated. But last year we found that we were cut off about \$15 million—about 10 percent of our proposed capital budget.

This makes it impossible to maintain the pre-contract engineering schedule and award schedule as previously determined. This changes the whole thing.

The next major problem is additions to the work schedule and award schedule. These occur for several reasons, such as commitments by the government and emergency situations that were not foreseen.

Obviously, when you add such additions into the very complicated stream of work required in preparing jobs for contract, it upsets the balance markedly. There is no time to make the necessary soil investigations, no adequate time for property acquisition, liaison with utility companies, etc. However, this is a problem which I think is going to continue. You will never entirely get rid of it. The only thing is to try and cut it down to a practicable minimum.

Many people in the highway department itself do not realize fully what the implication is when a statement is made, "We want this contract advertised by such-and-such a date."

I do not think some really understand just how much work is involved in preparing a job for advertising. I think it is still a hold-over from the days when the chief engineer would get on the phone to the district engineer at the beginning of the week and say, "We are going to have a job advertised on such-and-such a road by the end of this week."

However, we are becoming more successful in convincing people that when a project is added in that manner, something else must be delayed; and furthermore, the fact that they are adding it upsets the work schedule and workload of all staff involved.

The next problem is additions to project scope. As time goes on, a project often grows in scope; that is, it includes more work done than originally anticipated. So this obviously will increase the cost, and allowance should be made for that.

Next is the problem of making preliminary estimates and setting up the award schedule, etc. At the time that this must be done, frequently no detailed estimates are available in advance. That is, the design and specifications have not been completed, and you have to rely on past experience and past jobs of a similar nature to arrive at some cost. In doing this, we have been consistently low in estimating the actual cost of the job. Therefore, we have had to add 10 or 15 percent, after arriving at what was thought to be a satisfactory preliminary estimate.

The next problem is that although we have our lead time fairly well down to a regular routine, now, it still is not enough time to prepare all the various phases of the projects properly. Our budget doubled in four years, and many short-cuts had to be taken to have projects prepared on time.

We have the situation where we are awarding contracts just ahead of the movement of utilities and the acquisition of right-of-way. This, obviously, leads to claims once the contractor gets in and he is held up by these various factors.

The last problem is change of standards. A job will be almost nearing completion, or even completed, and then the design standards will be changed.

Someone mentioned that at one time you are 90 percent complete and yet later you are only 10 percent complete, due to a change in location or standards.

I would like to outline some of the goals that we think should be achieved.

First, time, money and staff requirements should be adjusted so as to enable projects to be done when they are needed. In other words, we should not allow, as far as it is possible, for those factors to dictate when the job is to be done. Rather, we should say when the job should be done and adjust staff, time and money to meet that date. True, many difficulties will be encountered in achieving that, but that should be the aim.

Use of consultants has helped to a great extent. Just two years ago, for example, about 60 percent of our bridge design was done by consultants, simply because we did not have the staff to have this work prepared on time.

However, our goal is to have about 75 percent of the work in the pre-contract engineering done by our own forces, and leave about 25 percent for consultants.

Second, the award schedule should be set up for at least four years in advance of construction. This will allow the time for all necessary functions to be carried out.

The program in any one year should consist of taking on construction of new projects, plus continuing projects under way, and the movement of utilities, the clearing, fencing, and acquisition of right-of-way on projects that will be started in the following year.

Breaking down that four years, we should take three years to prepare a project and one year for the acquisition of right-of-way, utilities, etc., so the project should be scheduled at least four years in advance of construction.

This does not take care of some of the more major projects in urban areas, where it takes a lot longer. These possibly will have to be six or seven years in advance.

Third, efforts should be made to accelerate the output so as to get ahead of the game. This will eliminate the use of short-cuts that are now being taken in the preparation of pre-contract engineering, and it would also make the programs a little more flexible.

I think that the award schedules should be such that flexibility is inherent in them, so that if a change is required for various reasons, the change could be made. You would just have to delay one and advance the other, because the engineering has been completed on both.

We are trying to achieve the goal where the engineering for the preparation of advertising of a project is finished at least a year in advance of that advertising.

The next goal in conjunction with the first goal I mentioned, (adjusting time and money requirements to fit the jobs when they are needed) is that the procedures and organization should be carefully scrutinized to see that they are functioning as smoothly as possible to cut down to a minimum time for preparing the job.

Lastly there is the future role of computers in this work. We think that there is a real future in the utilization of computer work in setting up and control of award schedules.

Aitken.—In Figure 1 of your paper, you referred to a steel stock pile. Does that mean you furnish steel to your contractors?

Bidell.—Yes. This does not include prefabricated steel. It is just reinforcing steel and standard rolled shapes.

Aitken.—In your advance calling of tenders (bids) (Fig. 6), you have total estimated cost. Do you always give the contractors an estimated figure?

Bidell.—No. This particular sheet does not go to the contractors.

Aitken.—In your graph on structure contracts (Fig. 16), are those accumulative for all of your construction contracts that are operating at any time, or active?

Bidell.—No, this is for an individual structure.

Aitken.—I am more amazed, then. You mean you let a bridge contract in April, and the first month you have that much expenditure?

Bidell.—No, that means, if you let an average structure in April, by the end of the fiscal year, ending March 31, you would have made that much expenditure, over nearly a year.

Another example: at the very end of the curve, if you awarded it in February, which is just a month before the close of the fiscal year, you do not spend very much during

that particular fiscal year. If we awarded a structure in August, we will spend about 70 percent in the fiscal year.

Granum.—You might add, that up until recently, Ontario had not had pre-qualification of contractors, and so there has been some difficulty in adhering to a completion schedule once an award is made. But more recently, you have improved on that situation.

Bidell.—Prior to 1956, there was no pre-qualification or liquidated damages clause in the contract; we could award a contract and then nothing would be done for a year. On that basis, it was extremely difficult, if not impossible, to estimate how much money was going to be spent on that particular contract in a given time period.

But now, with pre-qualification of contractors, and also liquidated damages, we can make a very close approximation of what will actually be done.

It is true that we do encounter some problems. In setting up the number of working days on which the liquidated damages are based, no work is planned for the winter. That is, there are no working days set up during the winter. So the contractor could shut down. But that does not mean the contractor could not work during the winter, if it is rock excavation or something like that. If he so chooses, he could do this type of work during the winter, in which case the job might be finished a little sooner than we had anticipated. But this does not happen very often. Our severe winters rather insure that.

Campbell.—Can those charts on percent of work done during the fiscal year be used in other areas or States? Are the charts influenced by the number of working days set up in a contract, or is the number of working days taken from the chart? What is the relation between working days and work needed?

Bidell.—The working days are not taken from the charts. Working days are estimated from past experience—how long it does take a contractor to complete a certain type of job in a certain region at a certain time of year.

Of course, the two are tied in very closely, but from independent analysis. I mean there is no force that is bringing them together—that is just the way it comes out.

Campbell.—Do you think those charts might be useful here in the States?

Bidell.—Yes.

Granum.—Pennsylvania and other States have similar work time and expenditure charts.

Campbell.—How many charts has Ontario developed?

Bidell.—The charts that we do have are in the paper. We can see a lot of deficiencies in these charts. They cover too wide a range. They do not take into account the type of grading work, whether it is all earth or whether it is all rock.

Furthermore, these charts also can be extended to take care of the amount of money that will be spent in the second year of the contract.

Right now, we have found that in the second year, of the total value of the work that is carried over into that year, approximately 85 percent will be spent.

For the moment, that is the only way we have of estimating how much will be spent in the second year of the contract. But with the accumulation of more data, I think that we can also come up with similar charts for the second year, and the third year, if it became necessary. Probably it should all be put on a computer.

Morf.—Have you established any particular parameters in the charts? You mentioned the size of the project. You mentioned weather, which you could also say is a function of latitude. I was wondering how far you would rationalize the parameters that apply to these curves.

Bidell.—I do not think that you could go very much further on that; except, as I say, to narrow down the range of these parameters.

Morf.—The month of the year in which a contract is awarded is another thing.

Bidell.—Yes. We are using the month of the year, now. If it is awarded in that month

of the year, so much will be spent. But I do not think you can tie it down any closer than that.

Babcock. — Bidell, in Ontario who determines the projects that actually are going to be awarded?

Bidell. — I do. That is, of course, I prepare them for the necessary approvals, etc.

Babcock. — Is that list approved by something like a highway commission or a legislature? Is it strictly engineering, or is there liaison such as a highway commission in the people's interest, so to speak?

Bidell. — First, of course, it is approved by the top level, insofar as engineering is concerned; and then a meeting is held with the political head, the Minister of Transportation.

Babcock. — The Minister would normally make a final determination, then?

Bidell. — That is right. In that regard we have not encountered very much change when it is presented to the Minister of Highways. About 95 percent of our program is based on bona fide needs, and the other 5 percent is something that one cannot do anything about.

However, even as far as the 5 percent is concerned, it is true that the project often is only advanced. We might not have had it planned until, say three years ahead. Now, we might have to advance it to only one year ahead.

So talking about this 5 percent, it is not really as though a job is pulled out of the air that nobody has anticipated doing any work on at all for the next 10 years, and then suddenly you are confronted with something that must be done right now. So the net effect of outside influences other than engineering, I would say, are maybe only 2 percent, on that basis.

If you have the engineering answer as to why unwarranted projects from an engineering point of view should not be put in a program, I think that you will be backed up about 90 percent of the time. However, if you do not have an answer, you are done.

Donnell. — I would like to know how you get right-of-way a year in advance of letting the contract.

Bidell. — There is a fund set up for right-of-way acquisition. You will see in Figure 1 of my paper those services mentioned. That includes the acquisition of right-of-way.

Donnell. — I understand that; but how do you keep from building the project once you get your right-of-way cleared and utilities adjusted? How do you keep the pressure of the public off your back for a year before you let that project?

Bidell. — Because we have already made it known that we are going to do that job. I think this is one of the advantages of actually publicizing an approved program, arrived at mainly by engineering considerations.

The fact of the matter is that this is the program we are going to be doing during the following year. So there should not be any fear of providing a right-of-way for the project and clearing the right-of-way, etc., and then finding out that you are not going to do it.

Livingston. — In Figure 4 of Bidell's paper, there are dates for closures for certain phases of the engineering work. They have been established. I want to know what authority lies behind these, who establishes that authority, and what do you do when somebody falls down on meeting their deadline, throwing the schedule out of gear?

Bidell. — It is not really a case of authority. Once the date is set, that is it. Everybody works towards that date.

Livingston. — But you have a number of diverse engineering divisions that have to be coordinated here. One man establishes final design criteria. This is fairly easily done. Then the location section, maybe because of weather or something else, does not get its work done on time, which leaves the designer in trouble, because he does not have the necessary information to start from.

How do you enforce the engineering work schedule, or keep it adjusted and coordinated?

Bidell. — We attempt to take care of this in advance. In setting up the schedule, if we find that the location section could be finished, it will be too late for any soils investigation to be done (other than for structures, foundation problems, etc.). So we do not set that early a date for location. We extend that date on until perhaps May of the following year.

Livingston. — Then you revise your schedule to fit these kinds of conditions that come about?

Bidell. — It is not really a revision. We attempt to set it up that way in the first place, to take care of these problems.

Granum. — You will find that you have frequent conferences to readjust the schedule. As a matter of fact, the schedule in your paper is a revision, dated January 20.

Bidell. — No matter how well you set up the schedule, there are always going to be changes. There are unforeseen delays. That is why I mentioned previously that the time we have set up, as shown here, is really too short. If there are no delays, or any serious delays, we can get it done. But with more lead time, if one section is late, you can push another section to get its work done a little sooner to make up lost time and still meet an advertising date.

The schedule system that we now have set up is too short, but it was done that way with a purpose. That is, if we had not set it up in that short length of time, it would have taken us several years to get to the point which we should reach, that is, getting the engineering job done a year ahead of construction. So we had to tighten up the schedule.

Burnes. — Bidell, who has the authority to do the pushing? Where does that authority come from?

Bidell. — All the people involved here are under the Director of Planning and Design. The authority comes from him.

Livingston. — You said you had jobs that get to the 90 percent completion stage on engineering, and then the next day you are at 10 percent because of a change in design. How do you handle that?

Bidell. — You mean that somebody might say, "Oh, this section is no good. We will have to change it. The shoulders are too narrow, and so on." We do not have much trouble with that, but rather in the detailed design. That is, for example, lately a decision was made to carry the granular material out to full width of shoulders. A change like that might require the whole job to be scrapped and recalculated. There will come a time when most of these things will settle down.

Morf. — I think most of us here do not have to be exhorted to do good and avoid evil. I think we know what good and evil are and we know what the problems are in achieving good.

But the next step is: Given an array, good or evil, of work to be gotten into a program, how do you actually execute this in view of the limitations of time, of decisions, and of the management of funds? I think Mr. Bidell has done a very excellent job. I am particularly fascinated by something that apparently we do not know as much about as he does, and we would like to know more about it. That is his schedule of completion and time requirements, of any type of work. I think this is a very good contribution to the technique of programing.

Most of the States are up against a very peculiar financial cycle. That is, their money becomes available in a surge around the first of the year, when the licenses are sold; but this does not correspond with the period of greatest expenditure for construction, which usually occurs late in the summer and fall.

Also, the legislature meets when the balance is greatest, because funds are in, but construction expenditures have not yet begun. The legislature likes to look at a highway

fund balance of \$80 million that the treasurer reports is lying right there, and think of the many other things that they would like to do with it.

One of our big problems has been to maintain a very close scheduling of construction expenditures, so that we can point to a rock bottom point in the financial cycle; and this usually occurs in November, when cash balances are at a very low level. This is good.

Those are problems that have to be considered—they may be of technique rather than principle, but they are very crucial matters of technique.

Bidell.—When income is available at the beginning of the year, but you have not really started on your construction, would it not be possible to put this money in a holding fund?

Morf.—You are not going to conceal it from the legislature by doing that.

Granum.—Many States operate on an encumbered basis, as distinguished from a cash flow basis. I think you should realize that in Ontario it is on a cash expenditure, cash flow basis. Operation of such programs depend upon rate of expenditure or outlay of cash. Other States, which require encumbrance of full contract amounts against available funds or budgets, may have cash lying idle in the bank for a long time, even though the full amount is encumbered and will eventually be spent.

This is part of the budget management that Jim Martin discussed. It involves legislation relating to these things, and it involves money management, which is one of the reasons for the title of Bidell's paper.

Donnell.—When we program a project, our funds are set aside or encumbered, and therefore are never shown to the legislature as money that we have in our pockets. The project money cannot be used for anything else.

Granum.—Except that the treasurer's balance will show some cash, will it not?

Donnell.—He may have \$40 or \$50 million in cash, but actually only have a million dollars unencumbered.

Morf.—This is the story of my life, trying to explain the difference between an unencumbered balance and a cash balance. But I have never won. I do not know how. Do you take it out of the bank and put it in a wooden chest or bury it? How do you get it out of the treasurer's account?

Donnell.—The treasurer transfers it to his account.

Johnson.—In Kansas, we have six highway commissioners representing geographical areas. Available construction funds, other than Interstate, are split six ways on a percentage basis, without any particular regard for needs within the divisions.

This is not too bad, in a way, but it does result in some projects being advanced to construction much sooner than you would ordinarily like to have them, from a purely engineering and need standpoint; you could still tolerate them for quite a long time. Of course our worst problems are near the urban areas and in the eastern part of the State.

While the mileages in the different areas are quite comparable, the fund splits range from $9\frac{1}{2}$ percent to 24 percent of the available funds, arrived at by an agreement between the commissioners that were in office 20 or 25 years ago. Periodically, as commissioners change, the distribution of funds comes up for discussion: "Should we continue this as it is, or should we adjust it slightly?" Of course, the ones that are interested in adjusting are the ones that need a little more. But there has only been one change in at least 20 years, and I do not expect there will be anything happening soon in the future.

I do not know how many States have that kind of a situation and what they have done about it, if anything, or what can be done about it, or if anything should be done about it. It works fairly well.

Granum.—Legarra pointed out the "splits" they have in California, and I know there are other states that have similar splits. I know in Tennessee the highway needs study indicated a very nice split among the four divisions, each of which includes one of the four major cities.

Donnell. — That is right; but we do not have to split, by law or edict. We divide construction funds on the basis of need: 24 percent, 21 percent, 25 percent, and 29 percent.

Buswell. — In Montana, by State law, we split the Interstate funds into 12 financial districts on the basis of the Interstate need study. Finally we split that on the basis of deficient mileage. We split other funds into the 56 counties on the basis of land area, rural population, rural road mileage, and value of rural lands. Urban money is split among the 14 cities over 5,000 population on the basis of population.

Granum. — I would like to summarize Bidell's discussion.

Bidell pointed out first that the needs of the highway system come first; that the goal of a construction schedule should be to build the projects that are needed, when they are needed.

Second, the available funds are all-important, because the cash flow of expenditure must balance with the money that is available when it is needed.

Third, there must be time for planning and for construction. Within the time problem, the paper shows how an internal work schedule is developed, including the effects of contract letting dates and the time of construction itself.

One thing that has not been done completely, but I wish he had more time to do, is to show you something more about how they keep track of this. Ontario has an elaborate system which is continually undergoing revision.

Work schedules mean nothing unless somebody pays some attention to them, and that involves a high degree of reporting and control.