Programmed Calculation of Nedo Price Adjustment

By R W Grimes

Introduction

The program accompanying these notes is written for a Casio FX-502P programmable calculator, and can be used to calculate the price adjustment due under the Formula Rules using the NEDO indices. Both the Building and Specialist Formulae are accommodated.

As most surveyors will have encountered NEDO calculations at some time or other, this relatively simple but repetitive task has been chosen to demonstrate to those not familiar with them what programmable calculators can do and how to make them do it. To the others who are more enlightened (and probably divorced by now as a result) the program will hopefully be a useful addition to their libraries.

Land surveyors and engineers have been using programmable calculators quite commonly for several years now. The intention of this article is to try and stimulate the same interest and usage in the quantity surveying profession.

Program for Calculation of V.O.P.

It is appreciated that the most time-consuming aspect of operating the clerical part of the Formula Rules lies in collating or abstracting the valuations to obtain totals of the work done under each work category. For many surveyors though, particularly site-based staff in small practices operating without full comptometer back-up, the calculations themselves can become somewhat irksome, and therefore error prone.

The program described here is designed to relieve these latter aspects by eliminating the number of intermediate manual calculations necessary when using an ordinary calculator (or even humble brainpower . . .).

In the practice where I work we have overcome the collating of valuations mentioned above by using a Commodore PET computer, which also performs the fluctuations calculations and the automatic up-dating for firm indices. But then the

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investment in computer, printer and "software" will approach about £2,000 whereas a reasonably powerful programmable calculator can be bought for about £100-150, perhaps less. I use this calculator program to do a quick check on the print-out produced by the computer . . . woe is he who trusts machines. It is also useful for checking/calculating the fluctuations for say nominated sub-contractors or 'fix-only' indices, which are not usually worthwhile putting on the main computer program.

Multi-Purpose Program

The use of Program P1 is of course not confined to NEDO calculations: it could be used equally well to back-date, up-date or adjust costs using the BCIS or other indices.

The sub-routine Program P9 can be used to correct any number to any designated number of decimal places—in effect the "software" controlled equivalent of a decimal place correction facility often found on ordinary calculators. As such it also forms a useful sub-routine for use with many other programs, though I do not claim any originality for its conception.

The sub-routine Program P8 can be used to multiply any number by a constant which could be retained (on the Casio) in memory even when the calculator is switched off.

It should be noted that other programs can be written and stored in the remaining free program memories P3, P4 and P5 of the Casio, subject to not exceeding the maximum 256 program steps available (with the NEDO program entered as written, 158 steps still remain for additional programming).

Conditional Jump

Not a test of physical fitness this, but if you do not have a programmable calculator, or you already have a Casio FX-501/2P please read on from "Choice of Calculator"—in other words execute in programming jargon a "conditional jump or branch" to that part of the program labelled "Choice of Calculator".

Other Calculators

For calculators other than the Casio, such as those manufactured by Texas Instruments, Hewlett-Packard, Monro, Sharp, etc., readers should be able to translate the NEDO program into a form suitable for their own machines using the comments accompanying the "listings" (those of you who have developed computer failure and therefore have not executed the above conditional jump missing out this section, may not know that a "listing" of a program is exactly that—a list of the program steps or instructions).

If it appears that your own machine has insufficient program or memory capacity, note that some of the steps described are not necessarily efficient programming, and that other steps such as the user prompt formats of the display (o.°°) are not essential to

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subcontract follows a method similar to that described above for the main contract; start with the subcontract sum as stated in NSC/4 Clause 21.10.2.

NSC/4 Clauses 21.10.2.1. to 21.10.2.4. list amounts to be deducted.

NSC/4 Clauses 21.10.2.5. to 21.10.2.11. list amounts to be added. This method applies where there has been a lump sum quoted and accepted. Where there was a lump sum subject to complete remeasurement quoted and accepted then NSC/4 Clause 21.11.2. sets out how the final subcontract sum is to be ascertained.

An important clause to note is Clause 30.7. Under this clause the architect must issue an interim certificate which must include the amounts of the subcontract sums as finally ascertained or adjusted and this interim certificate must be issued not less than 28 days before the issue of the final certificate. This enables the provisions of Clause 35.13.5. to operate, whereby (providing that Agreement NSC/2 or 2a has been executed) the employer is obliged to pay the subcontractor. This obligation is reduced if the amount owing to the contractor in the next certificate is less than the amount to be paid to the nominated subcontractor.

Another important clause to note is Clause 35.17. whereby (again provided that NSC/2 or 2a has been used and provided Clause 5 of NSC/2 or Clause 4 of NSC/2a is unamended) the architect must issue an interim certificate within or on the expiry of 12 months from the date of Practical Completion of the subcontract works, which certificate must include the finally adjusted or ascertained subcontract sum (provided that the subcontractor has complied with the provisions of Clauses 35.17.1. and 35.17.2.

It will be seen from the above that the provisions of the subcontract and the main contract are now very closely linked and interwoven and that to determine the rights and duties of the main contractor and the nominated subcontractor, both the Subcontract Conditions of Contract and the Main Contract Conditions, together with the documents and agreements entered into when tendering must all be carefully studied and understood.

executing the calculations. The program is written so that what the machine is being asked to do should be readily understood, and to make operation as straightforward as possible.

Choice of Calculator Generally

As you have probably gathered, the machine I use is a FX-502P which has the larger memory capacity of the two programmable machines available from Casio. I would suggest that for the £20 or so difference in price of the two the 502 with twice the memory of the 501 is more cost effective. To give an idea of price, the 502 costs about £110 including VAT complete with an adaptor, or "interface", for recording/recovering programs and data from a tape recorder equipped with earphone and microphone sockets.

Compared to other calculators in the same price range that I know of the Casio offers the following advantages, which I accept may reflect personal taste:

—non-volatile memories, in other words programs and memory are retained even when the machine is switched off.

—facility to store programs and data on magnetic tape or cassettes.

—when used with a battery operated cassette recorder (eg. a dictation recorder) the system becomes a very portable and powerful computing device unrestricted by the availability of mains electricity.

—the programming language is readily convertible to BASIC and hence programs can be made to run on a micro-computer: consequently the calculator could provide a relatively cheap introduction to computer programming.

However, there are other machines offering similar and sometimes more sophisticated features though they are either more expensive or perhaps too powerful. In the latter respect it is really a question of balance.

For quantity surveying operations where portability or simple problem solving are the criteria, I find that the Casio has sufficient capacity for the likely problems to be solved in that situation. For operations where complex problem solving is required, as in cost modelling, then programming and operation tend to be more complex as well and more likely to be solved where mains power is available. In this situation one might as well spend the extra money and buy a micro-computer which can provide much larger memory and communication in dialogue as well as numbers. For comparison, a Commodore PET, for example, would cost between £500 and £800 including VAT, depending on the size of memory.

Having said this the time will soon come when the two types of machine will merge into one and the same, as can be seen in the recently introduced Sharp PC-1211 which will be sold as a pocket computer at about £130. This machine is programmed in BASIC and should have sufficient programming capacity for the NEDO program, provided the dialogue is kept to a minimum.

EXAMPLE 1 — USING PROGRAM P1 FOR BUILDING FORMULA

Valuation Information:

Work Category	*Valuation*	*Current Index*	*Base Index*
2/6	£1,000.00	110	100
2/7	£2,000.00	110	100
Total	£3,000.00		

Key	*Display*	*Reads*	*Comments*
P1	0.°°	HLT	Input required – valuation
1000	1000.		£1,000.00 for work category 2/6
EXE	0.	HLT	Input required – current index
110	110.		110
EXE	0.	HLT	Input required – base index
100	100.		100
EXE	100.		Gross NEDO increase, £100.00
EXE	0.	HLT	Input required – valuation
2000	2000.		£2,000.00 for work category 2/7
EXE	0.	HLT	Input required – current index
110	110.		110
EXE	0.	HLT	Input required – base index
100	100.		100
EXE	200.		Gross NEDO increase, £200.00
EXE	0.°°	HLT	Input required – valuation
			All valuations entered, press EXE
EXE	3000.		Total valuation, all work categories £3,000.00
EXE	300.		Total Gross NEDO fluctuations, £300.00
EXE	270.		Total Nett NEDO fluctuations, after deducting 10% non-adjustable element, £270.00

Is Programming a Calculator Difficult?

This rather depends on the calculator and the accompanying documentation. I personally find the Casio the easiest to program of those available as the language and structure of the programming is similar to the FORTRAN learnt in my college days, and more recently to the BASIC learnt for the PET. Without this knowledge to supplement the manufacturer's somewhat cryptic hand-book learning programming would be time consuming but not difficult. Other manufacturers, particularly Texas Instruments, produce far superior and easier-to-follow instruction manuals than Casio's.

A good book for anyone without programming knowledge is "How to Program Your Programmable Calculator" by Stephen L. Snover and Mark A. Spikell, which should be of general interest even though written for the range of Texas and Hewlett-Packard calculators.

Learning can be done in stages of course and even in the first half-hour of study I would imagine that most people could make the machine count by itself for example—using a programming feature known as "looping" (there are program loops in Programs P1 and P2, which demonstrate why such counting is necessary). In addition it is not necessary to master the full capabilities of any machine before being able to put it to good use. One does not have to be a racing driver to drive a car, for example.

From my own experience, four main points come to mind concerning programming whether for computers or calculators:

1. It is not too hard to write a program to solve a problem—but it does take time and concentration.
2. It is even more time-consuming to write a program and document it so that
   (a) others have a reasonable chance of using and/or understanding it, and
   (b) so that the originator can remember why he did it that way after the program has not been used for a while.
3. Of the programming necessary, that part which solves the problem is usually of minor complexity compared to getting correct data in and results out.
4. Once written, however, a program is always there to be used over and over again at the press of one or two buttons.

Calculation of NEDO Fluctuations: Casio FX-502P

Program Description	*Steps Used*
P0—Input of % non-adjustable element	12
P1—NEDO Calculations (series 1 or 2), alternative to P2	27
—Building Formula	
—Electrical Installations Formula	
—Heating and Ventilating and Sprinkler Installations Formula	
—Structural Steelwork Formula	
P2—NEDO Calculations (series 1 or 2), alternative to P1	32
—Heating and Ventilating and Sprinkler Installations Formula	
—Electrical Installations Formula	
P6—Sub-routine to perform calculations of increases	10
P7—Sub-routine to set number of displayed decimal places	2
P8—Sub-routine to allow for % non-adjustable element	3

EXAMPLE 2 — USING PROGRAM P2 FOR SPECIALIST FORMULAE

Valuation Information:

	Valuation £2,000.00	*Weighting*	*Current Index*	*Base Index*
Labour		40%	110	100
Materials		60%	110	100

Key	*Display Reads*	*Comments*
P2	0. HLT	Input required - total valuation
2000	2000.	£2,000.00
EXE	0.°° HLT	Input required - labour weighting
0.4	0.4	40%
EXE	0. HLT	Input required - current labour index
110	110.	110
EXE	0. HLT	Input required - base labour index
100	100.	100
EXE	0.04	= Increase in indices x labour weighting
EXE	0.°° HLT	Input required - materials weighting
0.6	0.6	60%
EXE	0. HLT	Input required - current materials index
110	110.	110
EXE	0. HLT	Input required - base materials index
100	100.	100
EXE	0.6	= Increase in indices x materials weighting
EXE	0.1	= Weighted increase in indices
EXE	200.	Total Gross NEDO fluctuations, £200.00
EXE	180.	Total Nett NEDO fluctuations after deducting 10% non-adjustable element, £180.00

P9—Sub-routine to correct to required number of decimal places, with round-up facility 12

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Note—Either P1 or P2 can be adapted for use with following Formulae:
—Lift Installations Formula
—Catering Equipment Formula

Memories Used

0	Counter for program P2
3	Current index number (P1 and P2)
4	Base index number (P1 and P2)
5	Running total of valuation (P1), or running total of weighted increase in indices (P2)
6	Amount of valuation for each category (P1) or element (P2)
7	Running total of gross NEDO fluctuations (P1 and P2)
8	Proportion of gross NEDO fluctuations remaining after deducting % non-adjustable element (P8)
9	Number of decimal places (P9)
.6	Total Valuation of Specialist Work (P2)
.8	Temporary store for % non-adjustable element (P0)

Program Listings and Flowcharts

INV—Certain steps are 2nd-function steps and require the INV key to be pressed first, but INV has been omitted for clarity.

* —Means multiply

/ —Means divide

P0–Input % Non-Adjustable Element

ENG	prompt user—input required
HLT	input % non-adjustable element
*1%	calculate decimal equivalent
Min.8	store in M.8
+/— +1=	subtract from 1 = proportion to be adjusted
Min 8	store in M8
AC	clear display

P1—NEDO (Alternative 1)

GSB P7	call subroutine P7 = set registers
LBL1	
AC	check display cleared
ENG	prompt user—now at start of program loop
HLT	enter valuation—to obtain totals after all entered, enter 0
X = 0	does display read 0
GO TO 2	Yes—jump to label 2 (totals required)
MIN 6	No—store valuation in M6
M+5	add to running total in M5
0 HLT	enter current index
MIN 3	store in M3
0 HLT	enter base index
MIN 4	store in M4
GSB P6	call subroutine P6=calculations
GSB P9	call subroutine P9=decimal places
HLT	display NEDO increase
M+7	add to running total in M7
GO TO 1	return loop back to label 1
LBL2	
MR 5 HLT	display total of valuations entered
MR 7 HLT	display Gross total of NEDO increases
GSB P8	call subroutine P8=non-adjustable
GSB P9	call subroutine P9=decimal places display Nett total of NEDO indices

P2—NEDO (Alternative 2)

GSB P7	call subroutine P7=set registers
2 MIN 0	set counter to 2 counter=2 labour increases counter=1 materials increases
AC	clear display
HLT	enter total valuation, labour and materials
MIN.6	store in M.6
LBL1	
AC	clear display
ENG	prompt user—now at start of program loop
HLT	enter weighting in decimal format first pass, labour second pass, materials
MIN 6	store in M6
0 HLT	enter current index

EXAMPLE 3 — USING PROGRAM P1 FOR SPECIALIST FORMULAE

Valuation Information:

	Valuation £2,000.00	*Weighting*	*Current Index*	*Base Index*
Labour		40%	110	100
Materials		60%	110	100

Key	*Display Reads*	*Comments*
P1	0.°° HLT	Input required - valuation
2000 x .4 =	800.	Valuation x labour weighting = £800.00
EXE	0. HLT	Input required - current labour index
110	110.	110
EXE	0. HLT	Input required - base labour index
100	100.	100
EXE	80.	Gross NEDO increase, £80.00
EXE	0.°° HLT	Input required - valuation
2000 x .6 =	1200.	Valuation x materials weighting = £1,200.00
EXE	0. HLT	Input required - current materials index
110	110.	110
EXE	0. HLT	Input required - base materials index
100	100.	100
EXE	120.	Gross NEDO increase, £120.00
EXE	0.°° HLT	Input required - valuation
		Valuation all entered, press EXE
EXE	2000.	Total valuation, labour and materials £2,000.00
EXE	200.	Total Gross NEDO fluctuations, £200.00
EXE	180.	Total Nett NEDO fluctuations, after deducting 10% non-adjustable element £180.00

MIN 3	store in M3
0 HLT	enter base index
MIN 4	store in M4
GSB P6	call subroutine P6=calculations
HLT	display weighted increase in indices
M+7	add to running total in M7
DSZ	decrement counter by 1—now zero?
GO TO 1	No—return loop back to label 1
MRZ HLT	Yes—display total increase in indices
*MR.6=	multiply by total valuation
GSB P9	call subroutine P9=decimal places
MIN 7 HLT	store Gross total of NEDO increases in M7, and display
GSB P8	call subroutine P8=non-adjustable
GSB P9	call subroutine P9=decimal places

P6 – Calculations

MR6 * (MR3 – MR4)/MR4 =	Memory 6 x (current index – base index) / base index
	Memory 6 contains,
	P1 – valuation
	P2 – labour or materials weighting

P7 – Set Number of Decimal Places

2 MIN 9	set number of decimal places to 2

P8 – Non-Adjustable Element Calculation

* MR 8 =	multiply contents of display by adjustable element eg. 0.90 for a 10% non-adjustable element

P9 – Decimal Places

* MR9 10^x	multiply display by 10^x where, x = contents of M9 eg. $10^2 = 100$
+ .5 =	add a ½ to display
INT	take the integer value of display
/MR9 10^x =	divide display by 10^x eg. $10^2 = 100$
	Note: for x = 2 numbers equal to or greater than 0.005 are rounded up ie. to the nearest penny.

Example Calculations

Inputting % Non-Adjustable Element–Program PO.

Use this routine first before doing any calculations, unless % non-adjustable element is zero.

Key	*Display Reads*	*Comments*
PO	0.°° HLT	Input required – % non-adjustable element
10	10.	10%
EXE	0.	10% now in M.8
MR.8	0.1	Recall M.8 to check, 0.1 = 10%

Note

In the following example calculations the figures chosen have been made deliberately simple so that the calculations and results can be more easily traced.

Before executing a fresh program run, the sequence

Mode 1 INV MAC

should be used to clear all memories. This sequence is not necessary if a program run is continued after being interrupted temporarily and the calculator turned off – in this event the running totals are retained in memory.

JOINT DOCUMENTATION BOARD

The Joint Documentation Board for Industrial Engineering Construction and Works, established in August of last year and sponsored jointly by the Association of Cost Engineers, Institute of Quantity Surveyors and Royal Institution of Chartered Surveyors, has now met on three occasions and set up two working groups to carry out its initial remit.

The Board itself comprises four representatives from each constituent body under the chairmanship of Mr. A. M. Millwood, FIQS, FCIOB, a Director of John Laing Limited and Past President of the Institute of Quantity Surveyors. The members of the Board have been selected to represent client and contractor interests as well as private practice.

Both Working Groups comprise three members from each sponsoring body, a number of whom are members of the Board, with, once again, client and contractor interests represented.

Working Group for a Standard Method of Measurement

The first working group, under the chairmanship of Mr. D. F. Parkinson, FRICS, MACostE, has as its remit to deliver to the Board draft proposals for a "Standard Method of Measurement for Industrial Engineering Construction Works" for submission to and approval by the Joint Sponsoring Bodies. It is the intention of the Group to fulfil this objective by 1st January 1984.

To meet this deadline it is envisaged that an initial draft of the General Rules and the individual Work Sections will be completed by the end of this year, with the second year of the project being devoted to consolidation of the previous year's work and consultation with specialist sectors of the construction industry as appropriate.

A Feasibility Study for a Standard Form of Contract

The second working group, under the chairmanship of Mr. Vernon Thompson, MACostE, is charged to conduct a feasibility study with regard to a standard form of contract for industrial engineering construction, so that the Board can submit recommendations for the attention of the Joint Sponsoring Bodies and provide a detailed breakdown of the costs and assessment of the time element involved in the preparation of such a document and its subsequent maintenance.

The Group expects to present its proposals to the Board by 1st July, 1981.

PROGRAMMES IN CONSTRUCTION—A GUIDE TO GOOD PRACTICE

The industry has long needed a source of reference on programming which is comprehensive, authoritative, and impartial; and at the same time is easily understandable to those with limited knowledge of the subject.

This need is now satisfied in 'Programmes in construction' which sets out to describe the use of programmes in the building process, the information needed for production of the programme and how the programme is central to the efficient management of a project. A construction programme is regarded as a statement of intended action which when properly used provides management with a plan of campaign and provides a common reference for the timing of all activities related to the project.

Standards for the preparation and presentation of programmes are examined and practical reasons put forward for use of the various techniques that are described.

The question of reviewing and updating programmes is examined and the decisions needed when deviations to the programme occur are described. The principles of programmes are examined and the information needed for effective programming is analysed in some detail.

The production of a programme commences with a planning brief which describes the essential factors relating to the project under consideration. The form and content of a programme are fully described and A1 and A2 charts are provided of five forms of presentation of programming information. Coupled with these charts is an analysis of the suitability of each programming technique in relation to type of building.

The development of the programme, the establishment of activities and durations are covered and the development of sequenced operations is described.

Information that is derived from programming is also considered including method statements, calendar dated schedules and graphs, financial graphs and the use of multi project programmes.

Various techniques of measuring performance are also examined and an Appendix in a checklist and report form is provided for the site visit report.

As a pre-publication offer the publication is available until 1st March from the Sales Office, The Chartered Institute of Building, Englemere, Kings Ride, Ascot, Berkshire, SL5 8BJ price £4.00 to CIOB members and £5.00 to non-members, plus 35p post and packing (normal price will be £4.80 and £6.00 respectively).

PROPOSALS FOR CHANGES IN BUILDING CONTROL PUBLISHED

Michael Heseltine, Secretary of State for the Environment, has announced publication of the Government's proposals for building control.

In reply to a written Parliamentary Question from Sydney Chapman, MP (Chipping Barnet), Mr. Heseltine said:

"The Government has published a Command Paper on 'The Future of Building Control in England and Wales', setting out our proposals for the system. Copies have been placed in the Library of both Houses.

"The prime concern must be to maintain the high standard of building safety which we enjoy in this country. But subject to that, there is scope for substantial improvement in the building control system. The Government's proposals are in particular designed to produce clearer and more usable Building Regulations, to exempt minor works which need not be subject to control, to simplify procedures, and to give the industry and the building professions new freedom to regulate their own affairs within the framework of national standards of design and construction."