CHAPTER III

SOFTWARE DEVELOPMENT

Considered the speed of field data acquisition using engineering seismograph in reflection survey, the quantity of data is not very large ; therefore, data processing in the field office can be done on microcomputer. By early 1980's GSC had developed the software to process common offset and optimum window on 8-bits microcomputer (Pullen and Hunter, 1986). At present 16-bits microcomputer is much more common and the software to process CDP data on microcomputer is not yet available. Hence, the software to process CDP data on 16-bits microcomputer is developed for this reasons.

System Requirement

The following hardware components are required to run the developed software :

- Microcomputer with 8088 microprocessor

    640 Kbyte RAM

    2x360 Kbyte Floppy

    disk drive

- Monitor (with graphic controller)

- Dot matrix printer (Epson FX-100 or compatible)

- DOS with VDISK command

Software Design

To process CDP data, many steps are involved. These steps include ; gain adjustment, static correction, CMP sorting, velocity analysis, filtering, and NMO correction.

A computer program to handle all of these steps will be very large and can not be fitted into microcomputer. Therefore, the program was developed into several program modules. Each module perform only one processing step (except gain adjustment and static correction). The processed data is then stored on a diskette. The format of stored data is common for all modules.

For CMP sorting, the program depend on field configuration and filename convention. The shot and geophones arrangement as shown in Figure 2-5 and 4-5 was assumed. And the following filename definition for data is use :

- characters 1-4 for location
- characters 5-6 for profile number
- characters 7-8 for record number
- file extension will be given by the software

eg. CMMU0201.TER means
- CMMU is the Chiengmai province and Maung district
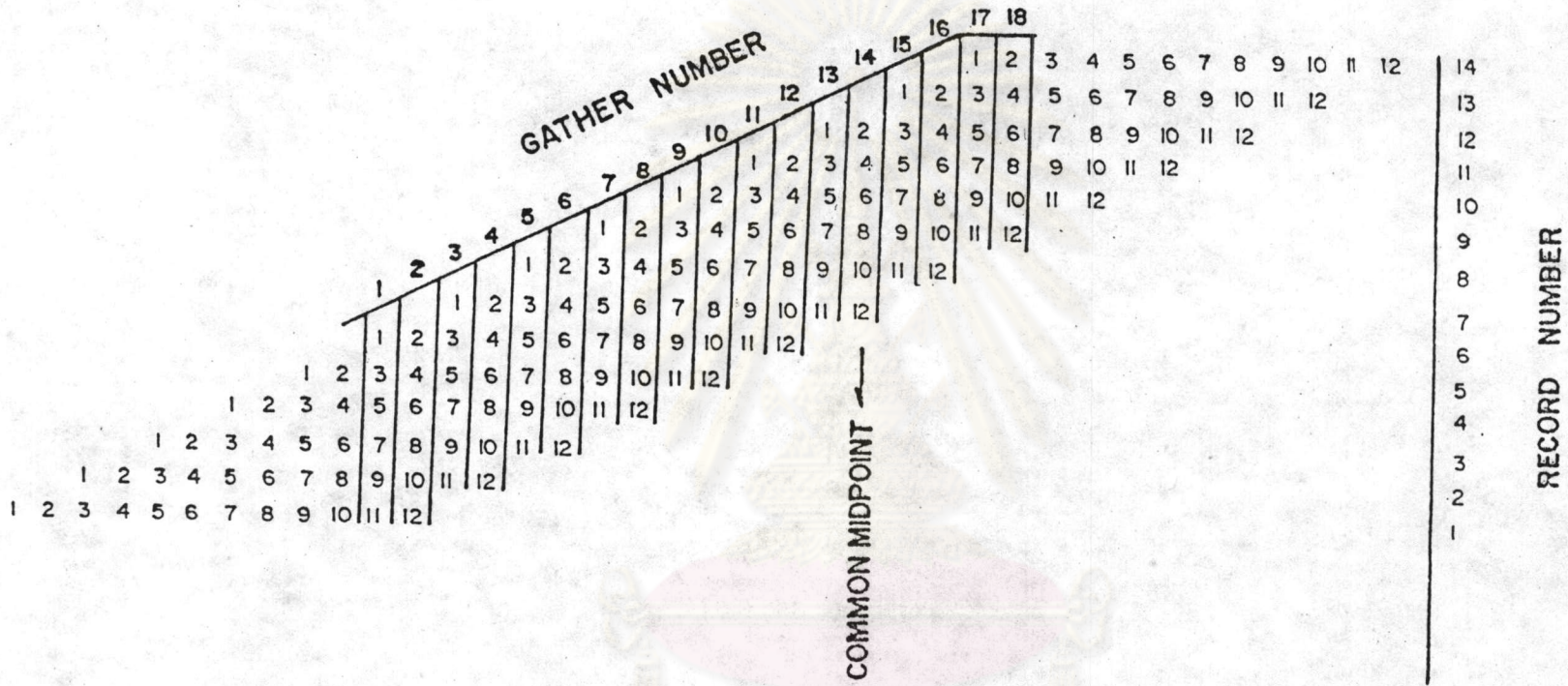
NUMBER OF GATHER = 2 X NUMBER OF RECORD — 10

Figure 3-1 Gather for field procedure in Figure 2.5.

- 02   is profile 02
- 01 is record number 01 on profile number 02. If there are more than 99 records in the survey line the profile number need to be changed. The record number must be consecutively increasing number for the consecutive shot.
- .TER is the file extension.

Processing Unit

The following program modules were developed : STA, CDP, NMO, and VEL.

STA This module is used to make static correction of 12 traces/record of CDP data and/or COS data. The static correction method in this module followed the method that the source and recievers are at the surface as was described in Chapter II (Figure 2-7). This module also include AGC and 3-points smoothing. The AGC gain factor for a given point is given by

$$\text{AGC gain} = \text{initial gain} \times \left[1 + \frac{\text{AGC Constant}}{\frac{\sum |\text{Amplitude}|}{\#\text{points}}} \right]$$

(Pullen,1986)

The 3-points smoothing is the weight average of 3 consecutive trace samples by 0.25, 0.50, and 0.25. The program listing is illustrated in Appendix C .

Table 3-1   The input example of STA module

```
          ********** STATIC CORRECTION **********
               ****        AGC        ****
          ********** 3-POINT SMOOTHING **********
              Insert SEISMIC DATA in drive A:
     Insert formatted disk for STATIC CORRECTION data in drive B:
              Press any key when ready
Static Correction of COP or COS (1/2) : 21
Enter Elevation from Header of Record or from Key board (H/K) K
File name (4 characters) : CMMU
Static correction at profile no. 2
Number of Station on Profile no. 2 = 13
Static Correction Begin at Record No. 1
   Which Shot at Station no. 1
Static Correction End at Shot No. 2
Shot offset (M) = 5
Geophone Spacing (M) = 5
Number of Traces/record = 12
Datum Elevation (M) = 308.00
Station no.  1  Elevation (M) = 309.00
Station no.  2  Elevation (M) = 309.00

                   etc
Average Velocity to Datum (M/S) = 550
If AGC is required type 1 or 0 if not : 1
Window before, window after : 40,40
AGC constant, Gain factor : 20,1
          ********** STATIC CORRECTION **********
               ****        AGC        ****
          ********** 3-POINT SMOOTHING **********
```

The example of this module input is shown in Table 3-1. The output from this module is stored on diskette with the same filename and file extension as the input file.

CDP This module is used to make CDP sorting of raw data or static corrected data of 12-traces/record. Six CDP traces are sorted according to CDP gather chart which is shown in Figure 3-1. The example of this module input is shown in Table 3-2. The input file extension must be either ".TER" or ".FIL". The output from this module is stored on a diskette with extension ".OGT" for gather number 1-99 and ".1GT" for gather number 100-188. The maximum number of record in a profile is 99 due to file name convention ; therefore, the maximum number of gather is 188. The program listing is illustrated in Appendix C.

NMO This module is used to make NMO correction of CDP gathered data. The module was modified from FORTRAN IV program written by Lohawijarn (1984). The NMO correction can be made for inputed velocity depth function which can be defined up to 10 intercept time/average velocity pairs. The example of this module input is shown in Table 3-3. The input file extension must be either ".0GT" or ".1GT". The results from NMO correction are then stacked and stored on a diskette as files of 12 traces with file extension ".0MO" or ".1MO"

Table 3-2 The input example of CDP module

```
This program requires data of 12 traces/record

and 14 records/diskette when start gather for 6-fold sorting


Insert 'DATa diskette' in drive A:

Insert formatted diskette for 'GATher data' in drive B:

Press any key when ready

CDP-SORT of FILtered data or FIEld data (1/2) : 2

Enter file name (4 Characters) : CMMU

Enter Profile No. : 2

Number of Record to be sorting : 96

Start CDP-Sorting at Record No. :1

              ************** CDP-SORT ***************

              ******** IN PROGRESS **********

              Gather no.        at record no.        trace no.
```

Table 3-3   The input example of NMO module

```
       ****** Normal Moveout Analysis *******
Insert 'GATthered data disk' in drive A:
Insert formatted disk for 'NMO data' in drive B:
Press any key when ready
Enter File name (4 character) : CMMU
Profile no. : 2
Total Number of Gathers = 96
Start NMO at GATher no. 1
End of NMO at GATher no. 96
Number of Fold = 6
Shot offset (M) = 5
Geophone Spacing (M) = 5
If STACKing is require type 1 or 0 if not : 1
Required NMO correction ? (Y/N) Y
No. of Layer = 2
Layer   1
Zero offset travel time (mS) = 34
Velocity (M/S) = 1250
Layer   2
Zero offset travel time (mS) = 50
Velocity (M/S) = 2500
Record length (mS) = 200
                ********* NORMAL  MOVEOUT *********
                *********  IN PROGRESS  *********
                NMO at Gather no.      Trace no.
```

depending on the number of stacked records. The program listing is illustrated in Appendix C.

<u>VEL</u> This module is used to make velocity of CDP gathered data, ie. file with extension ".0GT", and ".1GT". The module was modified from FORTRAN IV program written by Lohawijarn (1984). The velocity analysis is done by making NMO correction on a CDP gathered record at a given velocity, The result is then plotted on printer. The average velocity can be determined from flatted event on a series of printer output corresponding to different input NMO velocity. The method to compute stacking velocity is that of Pullen (1986) . The example of this module input is shown in Table 3-4. The program listing is illustrated in Appendix C.

Table 3-4   The input example of VEL module

```
****** VELOCITY ANALYSIS ******
Insert GATthered data disk in drive A:
Enter File name : CMMU
Profile no. : 2
Number of Gathers = 96
No. of fold = 6
Shot Offset (M) = 5
Geophone Spacing (M) = 5
Minimum velocity to begin analysis (M/S) : 1050
Maximum velocity to stop analysis (M/S) : 2300
Increment of velocity (M/S) : 50
Start analysis at GATher no. 1
Step  12
For AGC Input Window before ,Window after 40,40
AGC constant ,Gain factor 20,1


                        ****** VELOCITY ANALYSIS ******
                        ********* IN PROGRESS *********
                        Gather no.        Trace no.
```