Development of Control Point Management Module based upon GIS

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1. Introduction

The control point surveying result is not only the most basic data but also one of the most important data for reliable water resources survey of experimental catchment management.Also the accurate location of facilities around dam is essential requirement for guarantee of dam operation.Although bench marks are established beside the road, most of bench marks were lost during dam construction in case of Yongdam Dam. There is only one milestone left on dam's axis, which is used for measuring water surface elevation, butrests are over 20km away from the dam.

2. Problem

2.1. Inflow rate

Normally the water surface elevation of reservoir only measured at the axis of dam is used in estimation of inflow rate. There is no problem in dry season; however, this method is easy to make observation errors during the flood season because water surface elevation is not uniform. So many water surface elevation around reservoir are required to estimate accurate inflow rate during flood season.

2.2. Sedimentation amount

In the bottom topography observation for estimating sedimentation, measurement is very likely linked to the water surface elevation in reservoir. In case of Yongdam experimental catchmentin 2008, the elevation for the estimation of sedimentation was based upon GPS surveying.In case of GPS surveying, the problem is that network adjustment is performed using orthometric height quoted in measurement report of triangulation point and bench mark around dam. However, there are few bench marks around dam and reservoir. So bench marks from upstream were utilized.GPS accuracy is not very accurate, so it is better to refer to the nearest bench mark.

2.3. Facility

There are a lot of facilitiesaround dam such as intake tower, waterway tunneletc, including dam.These are closely related to water surface elevation in the flank of water supply. Also there must be required precise water surface elevation to manage and construct facilities around dam. Water surface elevation should be calculated with nearest control point from measurement point.As distance increases between two things, it is natural that error is large.

3. Control Point Management Module

3.1. Control pointsurveying

Establishing new bench mark is performed by spirit leveling. So new spirit leveling on each gauge wereperformed and established the new11 benchmarks at each gauge stations. The method was round-trip survey and we reviewed in conjunction with nearby benchmarks and set level to be equal to the distance between staff of F.S and B.S. As shown table 1, 11 bench marks were established for each gauge station in Yongdam experimental catchment. Table 1 shows the results of spirit leveling.

[Table 1] Control point surveying result

No.	Designation	Measurement Point	Zero Elevation (EL. m)		Note
			Existing	New	
1	Jucheon Bridge	6m from Staff Gauge	272.190	276.861	
2	Sageun Bridge	10m from Staff Gauge	-	260.907	indirect approach (TBM=272.047m)
3	Galdu Bridge	10m from Staff Gauge	-	260.996	indirect approach (TBM=276.866m)
4	Sukjung Bridge	8m from Staff Gauge	276.100	274.481	
5	Dochi Bridge	4m from Staff Gauge	270.168	269.460	
6	Yongpyuong Bridge	10m from Staff Gauge	-	260.807	indirect approach (TBM=269.0277m)
7	Jukdo Bridge	10m from Staff Gauge	-	261.238	indirect approach (TBM=269.998m)
8	Guryangchun Bridge	6m from Staff Gauge	291.500	298.114	
9	Yangak1 Bridge	1m from Staff Gauge	342.000	333.423	
10	Chunchun	4m from Staff Gauge	273.500	277.204	
11	Dukgokje	bottom of flux tower	-	688.568	

3.2. Module development

As part of the integrated water resources management in K-water Institute, management module for control point based upon GIS was developed. The module is programed with ArcObject component in .NET environment utilizing GIS Tool, which have been operated in K-water.

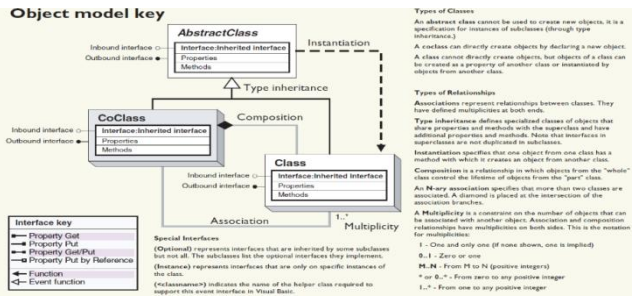

Figure 1. ArcObjectmodel key

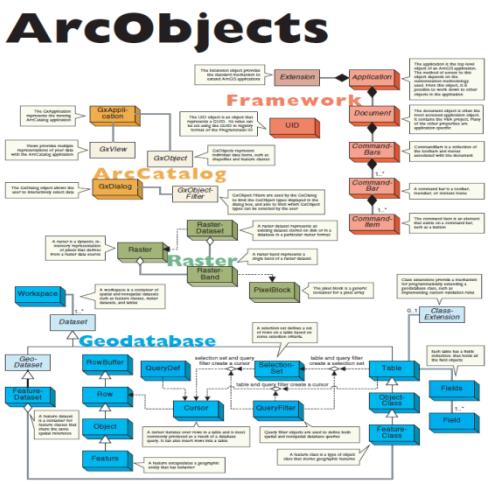

Figure 2. ArcObjectcomponent diagram

With this module, it is easy to see and manage the all of bench marks related information with the view of GIS thematic maps. The module provides search, add, edit, view and print functions. The bench marks are displayed together with catchment basin, river and road system and it is possible zoom in/out. It is possible to search for the class, number, administrative district, etc. and add benchmarks, edit information of existing bench marks. Each functions are shown in figure 1~4.

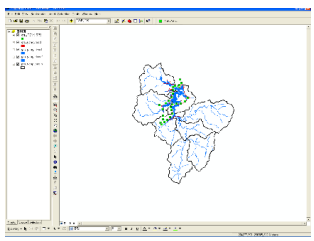

Figure 1. Main view of module

Figure 2. Search control point

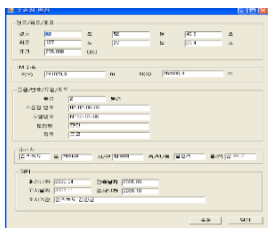

Figure 3. Edit control point

Figure 4. View and print

4. Expectation

In this study, we established benchmarks as 6 in water level station, 1 in weather station and 4 in reservoir and developed module to management control points based upon GIS. The control point management module is expected to contribute to manage existing benchmarks and decide location of new bench marks. With new bench marks, we can improve the reliability of water resources survey data in Yongdam experimental catchment. Also it can be used for estimating inflow, sedimentation, stage-discharge rating curve development, and construction and management of facilities. So it is expected to increase dam operation efficiency of YongdamDam. Alsothis study will be the cornerstone of integrated water resources management in experimental catchment management.

5. Reference

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[3] Study on Development of Fundamental Investigation Method for Water Resources at Experimental Catchment, K-water, 2011