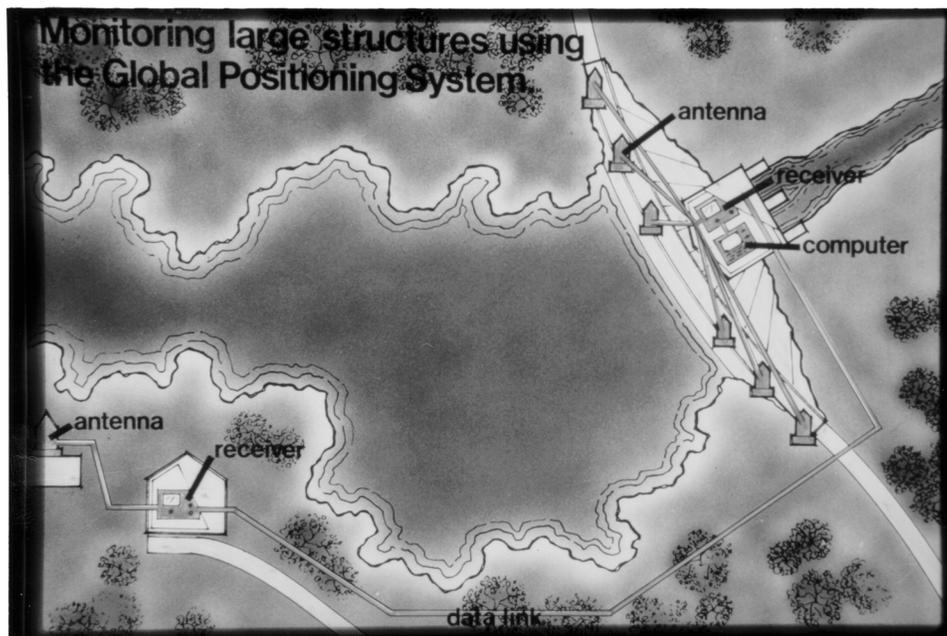




REMR TECHNICAL NOTE CS-ES-2,7  
CONTINUOUS MONITORING OF SMALL  
STRUCTURAL DEFORMATIONS



Schematic of a monitoring system

**PURPOSE:** To provide information about the development of a prototype system that will measure small structural deformations automatically and continuously.

**BACKGROUND:** The system was developed by the US Army Engineer Topographic Laboratories under the Repair, Evaluation, Maintenance, and Rehabilitation Research Program. Design, development and testing of the prototype system have been on-going for 5 years. The system was demonstrated at Dworshak Dam from July to September 1989.

**DESCRIPTION OF SYSTEM:** The system uses the NAVSTAR Global Positioning System (GPS). Monitoring and data recording equipment are linked together with telephone lines, RS 232 cable, or fiber optic cable. Between three and 10 GPS receivers are required, depending on the number of structural monitoring points. Two model 386 personal computers are required at the site, along with a telephone modem, cables, connectors, and other miscellaneous installation devices. Deformations are given at each station as: 1) a movement vector and 2) a time history plot. The software provides other customized deformation movement analyses and plots.

APPLICATION: To determine 3-D differential movements at up to eight points on a structure. Each position is then compared to an original position to determine the total amount of movement.

ADVANTAGES: The monitoring is continuous and automatic. No systems operator is required, and real-time structural deformations may be monitored at remote locations such as a district office. The system is accurate to approximately  $\pm 5$  millimetres.

AVAILABILITY: The software is available throughout the Corps from the Engineer Topographic Laboratories. Others can obtain copies from Trimble Navigation, Sunnyvale, CA. The NAVSTAR GPS receivers can also be obtained from Trimble Navigation. The computers, cables, and connectors can be purchased from any supplier.

COSTS: Approximately \$30,000 per GPS receiver plus \$50,000 for auxiliary equipment and installation. A three-receiver network would cost \$140,000 and a 10-receiver network would cost \$350,000. History shows hardware costs should drop by one-half over the next several years.