某新居工程沉降观测基准设计及数据分析

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摘 要：概述了成都市金牛区新居工程侯家 B 组团（一标段 4 号楼）沉降观测工程基本情况，就基准点的布设和基准网稳定性做了详细论述，通过监测数据分析该建筑物的变形情况并作出相应结论。

关键词：沉降；基准点；数据分析
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现阶段，主要的工程建筑物的变形监测在设计阶段就开始考虑了，设计单位在进行工程设计的同时，对工业与民用建筑物做出相应的变形监测设计，然后在建筑物的施工及运营期间进行定期观测，以保证建筑物安全。

1 工程概况

成都市金牛区人民政府沙河源街道办事处投资建设踏水新居高层住宅楼房，该工程位于成都市金牛区沙河源街道办事处踏水社区，住宅楼 4 幢（1-4 号楼），其中 4 号楼高 11 层，监测工作中共设 3 个水准基点，14 个观测点，观测历时 12 个月。

2 水准网的设立及检测

按照“分两步”建立高程控制网的原则。首先建立水准基准网，采用独立高程系，由以下 3 个水准基点构成水准闭合环，每次观测平差后的数据较差均小于高程中误差的 2 倍；并把基准点 BM-1 高程假设为 500 000.000 mm，来推算另外 2 个基准点的高程，见表 1。

表 1 基准点高程值/mm

点 名	高 程
BM-1	500 000.000
BM-2	500 223.435
BM-3	500 143.587

水准基准网、沉降水准网，采用自由网和非自由网的方式，为提高网的内可靠性和外可靠性，又采用了拟稳平差和非自由网平差处理，尽可能地削弱粗差和平差函数存在的模型误差对精度的影响。为了提高沉降点的高程精度，在 2006 年 8 月进行了初始值观测后，我们于 2007 年 1 月对水准基点进行了 1 次检测工作，其检测及稳定分析结果见表 1。每次水准基点稳定性检测工作完成后，及时对非稳定的水准基点的高程值进行修改处理，为观测数据的准确性提供了可靠依据，由表 2 可见各水准基准点稳定可靠。

表 2 水准基点可靠性比较分析表

测 段	首期高差/ m (2006-8-10)	二期高差/ m (2007-1-10)	与首期高差差值/mm	较差限差/mm	测量站数
BM1-BM2	0.152 64	0.152 02	-0.62	± 1.4	4
BM2-BM3	0.127 59	-0.127 63	-0.04	± 1.4	4
BM3-BM1	0.024 36	0.024 26	-0.10	± 1.4	4

在基准网的基础上建立以 14 个沉降点组成的沉降水准网（见图 1），以基准网为高程起算依据，计算沉降网各点的高程，并以各沉降点第一周期的高程值为起点推算以后各周期的沉降量和沉降速率，由于该网以结点的形式布网和观测，故而平差后的高程中误差较为均匀，对于描述大楼的垂直形变，有了更可靠的精度保证。

3 监测数据及变形分析

1）2006 年 8 月 10 日至 2007 年 8 月 20 日观测期间，最大累计沉降量为 5.795 mm（14#观测点），最小累计沉降量为 3.787 mm（6#观测点），最大沉降差为 2.008 mm（6#观测点～14#观测点），见表 3。

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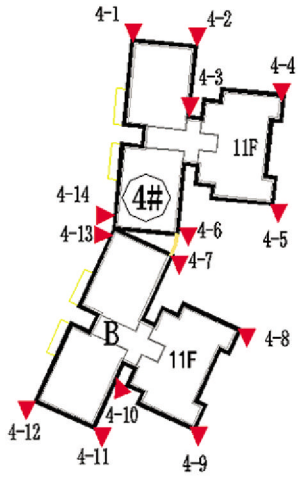

图 1　沉降点布置示意图

表 3　各观测点累计沉降量/ mm

点名	累计沉降量	点名	累计沉降量
4-1	4.187	4-8	4.550
4-2	4.257	4-9	5.037
4-3	4.147	4-10	4.381
4-4	4.299	4-11	4.585
4-5	4.016	4-12	5.093
4-6	3.787	4-13	4.544
4-7	4.190	4-14	5.795

2）在最近 6 个观测周期之间，即 2006 年 8 月至 2007 年 8 月，时间间隔为 374 d，其平均累计沉降量为 4.491 mm，平均沉降速度为 0.012 mm/d，见表 4。

表 4　各观测点累计沉降速率/mm/d

点名	平均沉降速率	点名	平均沉降速率
4-1	0.011	4-8	0.012
4-2	0.011	4-9	0.013
4-3	0.011	4-10	0.012
4-4	0.011	4-11	0.012
4-5	0.011	4-12	0.014
4-6	0.010	4-13	0.012
4-7	0.011	4-14	0.015

3）沉降量、荷载、时间（S-P-T）关系曲线图（见图 2）分析，从沉降曲线的分布情况来看，所有沉降曲线较集中，表明在观测期间本栋建筑物的基础不均匀沉降现象不显著。

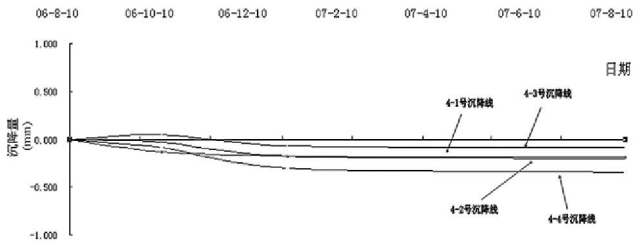

图 2　4 号楼 1-4 号点沉降量曲线图

4　结　语

经过对金牛区新居工程侯家 B 组团（一标段 4 号楼）实地观测数据的计算与分析，可作出如下结论：

1）根据金牛区新居工程侯家 B 组团（一标段 4 号楼）14 个沉降点 6 个观测周期结果来看，大楼随着增高荷载的加重，以及旱雨季节变化而引起的地下水的变化，各沉降观测点都在发生着沉降，但这些沉降趋势基本一致，说明是均匀沉降。

2）从沉降曲线的沉降趋势来看，2006 年 12 月以后所有沉降曲线开始逐渐趋缓，表明建筑物体物在 2006 年 12 月以后开始逐步进入稳定沉降阶段。

3）根据大楼各个方向沉降量来看，大楼对地基的压力比较平衡，各沉降点的差异沉降很小，由此看来大楼的整体受力比较均匀。

4）金牛区新居工程侯家 B 组团（一标段 4 号楼）的沉降观测点平均沉降速率在 0.012 mm/d 左右，各沉降观测点位的沉降速率均较小，说明基础比较稳固、平衡，未产生不均匀沉降。

5）各沉降观测点位的累计沉降量均符合规范要求，未见沉降异常。

6）建筑物未发现裂缝等异常情况。

7）金牛区新居工程侯家 B 组团（一标段 4 号楼）平均沉降速率为 0.012 mm/d，达到《建筑变形测量规程》JGJ/T8-97 规范规定：“沉降速率小于 0.01-0.04mm/d，可认为已进入稳定阶段。”

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other two methods.
Key words remote sensing image fusion, ALOS, land cover, classification (Page:116)

Application of ArcGIS Vector Data Spatial Anslysis in Urban Apartment Selection by YANG Jing

Abstract This study introduced the buffer analysis and overlay analysis in the spatial analysis of ArcGIS vector data. The two spatial analytic capabilities could be utilized to help potential buyers narrow down suitable zones by classify different zones and analyzing the practical situation in choosing apartments in the urban areas.
Key words spatial analysis, buffer analysis, overlay analysis, zone classification (Page:119)

Issues of MapGIS to ArcGIS Data Conversion Process by YANG Xiaochao

Abstract Spatial data conversion is an effective way to increase utilization and reduce duplicate collection of spatial data . Studying the spatial data format conversion can help to significantly improve work efficiency. This paper analyzed the characteristics of MapGIS, ArcGIS software,and explored the problems encountered during the conversion process.It especially analyzed the file corresponding conversion relationship between changes in properties of the field, Figure contour points, and found solutions . It made full use of two complementary advantages of software, so that to maximize sharing of data resources.
Key words MapGIS, ArcGIS, data format conversion (Page:121)

Topographic Map Scanning Digitization and Precision Analysis Based on CASS7.0 by CHEN Nan

Abstract The topographic map scanning digitization is an important acquisition method for GIS data, which has become the mainstream of the map digitization. This article Introduced the scanning digitization's basic principle and the implementation process and with 1:500 existing topographic map for data sources, using professional software CASS7.0 realized the whole production process of the map scanning digitization.It discussed the scanning digital mapping the main error sources and analysed the calibration accuracy and precision of vector in the process of scanning and digitizing.
Key words scanning digitization,gamma correction,precision analysis,CASS7.0 (Page:124)

MapX-based Mine Hydrogeololgy Information Management System by LONG Yang

Abstract This paper expounded the overall design of MapX-based Mine Hydrogeololgy Information Management System, realized the mine hydrogeology data management, maintainance, share and thematic map drawing by using re-development on MapInfo GIS software, the soft offered help to hydrogeology information management work.
Key words MapX, GIS, hydrogeology (Page:127)

Quality Testing Methods of Underground Pipeline Detection Resultsby XIE Zhiqiang

Abstract In the large area underground pipeline detection data checking process , it fully considered the hidden nature of its detection outcomes. We used scientific procedures, standards, sample control, GIS aids scientific and rational means to improve the efficiency of the inspection and ensure the quality of the outcome.
Key words urban underground pipeline detection, quality characteristics, quality assessment, data quality control (Page:129)

Design and Data Analysis of Settlement Observation Based on a New Home Construction in Chengdu by LI Yong

Abstract This paper summarized the new project of Jinniu district, Hou B group (a section of building no. 4) settlement observation engineering basic situation, including the benchmarks laid and detailed discussion of benchmark nets stability, through monitoring data analysis of the building deformation and made corresponding conclusions.
Key words settlement,benchmark,data analysis (Page:132)

Development of Data Processing Systems for Total Station Memory Records Observations by LIU Jiankai

Abstract In the process of traverse field observations, using the electronic record book for total station memory mode, againsting its data logging functions, we made the extract ion of lead observations, the secondary development of computing, and data processing corresponding. Full using of its code measurements function, we developed the data processing module, the extraction of data automatically,and converted them to the standard adjustment file that adjustment software could recognize,reduce labor intensity and the workload of outside the inside.
Key words Traverse,observations,memory record,data processing (Page:134)

Application of Chaotic Theory in Deformation Analysis and prediction by LU Jinjin

Abstract Due to environmental factors and instruments impaction,the deformation monitor can be seen as a complex system, and the parameters are uncertain and randomits, to show the complexity of the nonlinear behavior. The paper used the modern chaotic theory to solve the the time series of monitor deformation, and discussed the chaotic theory and prediction method. The example showed that chaotic time series method can get a better accuracy.
Key words deformation monitoring,chaotic time series,prediction (Page:137)

Application Experiment of SmartStation to Cadastral Inventory Based on the Second Investigation of National land by MEI Xiaodan

Abstract Taking the cadastral inventory of the Sanchahe town in Fuyu county as an example, this paper discussed the application of Leica's SmartStation in cadastral inventory based on the second investigation of national land.By compared the model of Leica's SmartStation without control points with the normal mapping model in accuracy and efficiency,it came to a conclusion that the former was a best way to improve the operational efficiency measurement in field survey .At the same time,this experiment was general and portable ,which had a certain importance to make further promotion in the field and space of super-station instruments.
Key words the second investigation of national land, SmartStation, cadastral inventory, accuracy assessment,the mode of location and measurement (Page:139)

Analyze Chaos of Deformation Monitoring Data by YUAN Changmao

Abstract This paper described the Lyapunov index method and the correlation dimension method of deformation data, and discussed the calculation of deformation monitoring data Lyapunov exponent and correlation dimension. Finally, it showed a practical example with dam observation data.
Key words deformation monitoring, chaos, Lyapunov exponent, correlation dimension, phase space reconstruction (Page:142)

Design and Data Analysis of Settlement Observation of Construction by YANG Jianrong

Abstract This paper summarized basic situation of settlement observational engineering which located in longquanyi district south road of

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