

# **OEEPE Project on Laser Data Acquisition**

## **Phase I**

### **Preliminary report**

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#### **Background of the project**

With airborne lasers scanning technique, a new method of data collection has evolved with a high potential for different mapping purposes. Up to now the results have mainly been used for visualisation of landscapes or for derivation of products such as digital terrain models. Also engineering tasks like power line measurements, are important applications. More complex tasks, as the derivation of 3D city models, are research topics at several universities. Both the numbers of data providing companies and the number of application areas are growing very rapidly. When the WG was initiated a handful of systems were operating. Now, one year later, close to 30 systems are in use.

Still, only a limited number of private companies are offering the data capture and the required post-processing, often using proprietary software developed by each company. As the laser scanning technology and also some laser parameters, as wavelength and laser frequency, varies between different systems, the results are difficult to compare. There is so far no standard concerning accuracy and reliability of data or recommendations for different parameters such as maximum point distances for a specific application. In order to get an overall view of the state-of-the-art concerning production and use of laser data, a working group was initiated within the OEEPE.

#### **Initial aims of the project**

The initial aim of phase I of the project was to investigate the user requirements of laser scanning data and derived products, such as DEMs and 3D city models. Users of laser scanning data were also to give information about their definitions and understanding of these products. A questionnaire was to be set up, concerning the requirements of the users, but also the user definitions of the derived products. Test data of different suppliers should be offered to those who are interested. The first results of the questionnaire and the state of the art using those data should be shown in a workshop. The final results of phase one should define

- common user requirements for laser data
- a common test area for phase II, if possible

In phase II a test area should be established comprising both dense built-up areas, forests and engineering objects such as power lines and railroads. The area should be surveyed by as many suppliers as possible. Data should be made public and tested for different applications by the members of the WG.

#### **Results from Phase I**

The main work in phase I has been the formulation of the questionnaire and the compilation of the answers. There is still some work to be done regarding the analysis of the answers.

The questionnaire was to investigate the current

- user requirements for laser scanning data, used for different purposes as
  - DEM/DSM derivation in wooden and/or urban areas,
  - orthophotos,
  - interpretation,

- 3D city models
- and so on;
- state of the art in research and development concerning the
  - surface data and
  - the derivation of other products as DTM or 3D city models.

The questionnaire was sent to about 300 addresses in 32 different countries of Europe. Of these, 79 were answered, corresponding to a return ratio of about 27 %. This is considered as a good return rate, revealing a high interest in laser data. This is confirmed by the 40 organisations that are not using laser data yet, but who are very interested in doing so. There are in addition 21 organisations that are testing laser data, most of them (15) universities. A quarter of the organisations that answered the questionnaire is already using laser data in production.

The answers from the questionnaire have been compiled in graphic form to make it easier to analyse. The graphics are found at the end of the report and a few comments are given here:

- Table 1-4: Statistics of all answers  
As seen in the graphics there is a good geographical distribution of both sent and returned questionnaires. Since we have been dependent on addresses given to us, countries with WG-members are generally better represented than other countries. Even though as many as 49 % of the received questionnaires told that they did not use laser scanning, they still found it worth returning the form.
- Table 5-12: Results of organisations using laser data  
It seems like laser scanning is so far mainly used within the mapping communities. This can also be due to the fact that we mainly sent out questionnaires within this area. There are many consultant agencies who hope for other applications, e.g., telecommunication and power industries, but so far these are minor applications. The main application areas of laser data are the production of DEM or DSM and the main reasons for using laser data are point density, high precision and cost effectiveness.
- Table 13-20: Results of organisations testing laser data  
If firms and administrations dominated the previous section, this part is dominated by universities. Otherwise the picture is very much the same. The interest is turned more towards 3D city models and the main reasons for using laser scanner data are point density, high precision and vegetation penetration.
- Table 21-25: Results of organisations not using laser data  
The reasons for not using laser scanner data are mainly lack of knowledge, price and that the organisations have not reached so far yet. Pricing seems to be a difficult issue, since this reason is used both in favour of and against the use of laser scanning.

There are some parts not yet analysed, e.g., 3D city models and engineering measurements. The final result will be reported after summer.

More details can be found in the attached graphics and at the Working Group's home page:  
[http://www.geomatics.kth.se/~fotogram/OEEPE/oeepe\\_laser\\_main.htm](http://www.geomatics.kth.se/~fotogram/OEEPE/oeepe_laser_main.htm).

The WG will present the results of the questionnaire and have discussions regarding the continuation of the project at the Photogrammetric Week and at the ISPRS workshop in Munich. A workshop was originally planned at the end of phase I. We do not feel that there is a need for a workshop at this stage, but want to wait until test data from phase II is available and analysed.

## **Status for phase II**

The aim of the second phase is to establish a test field that can be used for testing and evaluating laser scanning systems and data processing algorithms. There are several problems related to this:

- The test area should satisfy several different types of applications, e.g., open fields, forests, dense city areas, power lines and water surfaces.
- If the absolute accuracy of the systems are to be evaluated the checkpoints in the test field must be of very high quality. Photogrammetric data is not of enough quality for this purpose.
- Unless the participating companies are paid to do the surveying campaigns, there must be a strong incentive to participate. If several data providers are participating this will be a good reason for others to participate as well. If only one or two companies are willing to do the flights they might not find it worth doing in the end.
- The test field should be located in a, for as many as possible, convenient place. One suggestion is the Vaihingen test field which have been previously used for similar tasks. One drawback is the lack of dense city areas. Another possibility is to make a test flight in connection with other production/research campaigns. A collaboration with Prof. R. Galetto, University of Pavia, Italy, have been discussed for this purpose.

There have been discussions with at least three companies who are willing to do such test flights, at least if they have some other campaign close by. In order to compensate the companies, or at least show our "good will", we hope to receive some money for this purpose from the OEEPE, see action plan.

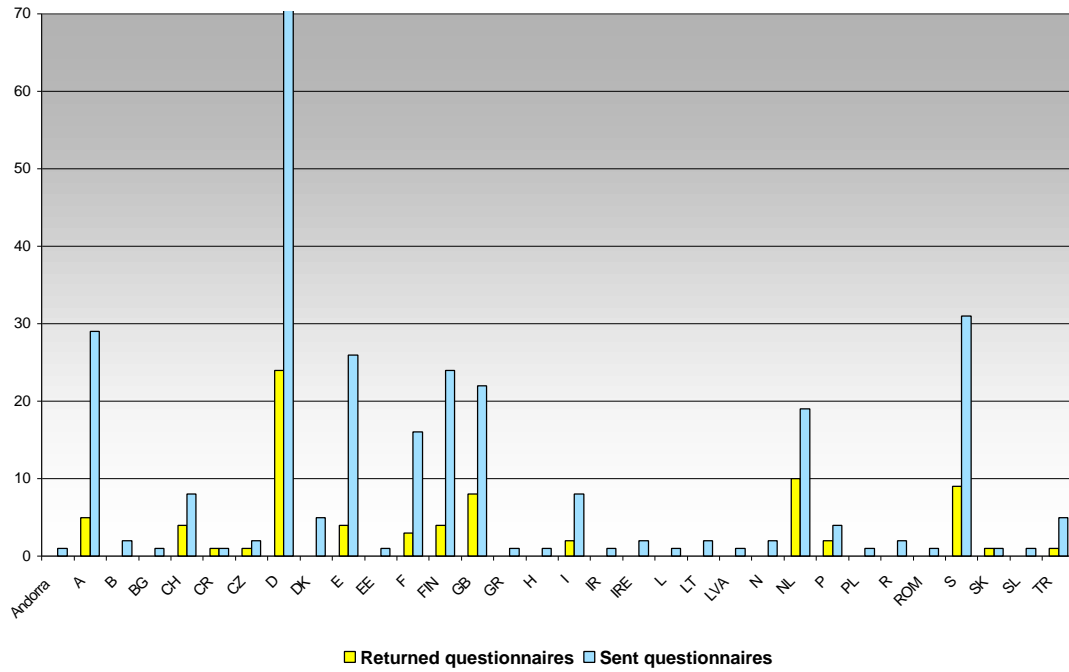
## **Plan of Action**

The WG will continue with phase I and II according to the following plan:

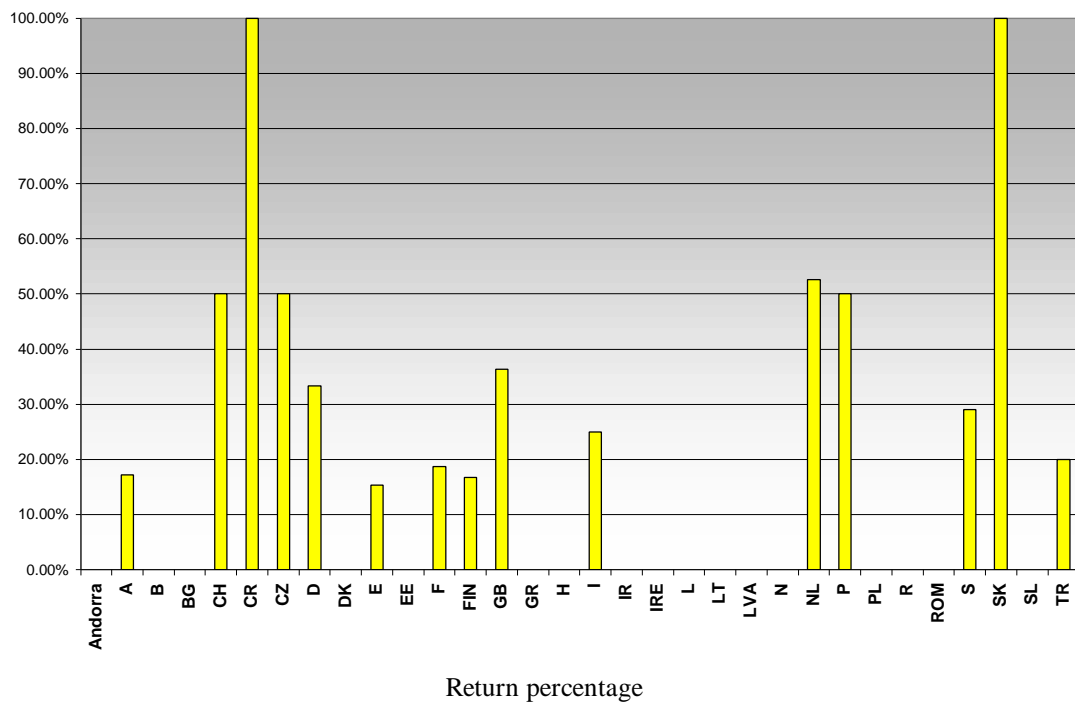
- Continued analysis of the received answers from the questionnaire
- Writing a final report for phase I
- Report the result and discuss further work within the WG at ISPRS workshop in Munich, September 9<sup>th</sup> 1999.
- Continue to plan for test flights during the fall of 1999.
- Try to attract data providing companies to the project. *For this purpose we ask for a sum of 15 000 DEM to be used for showing our appreciation for participating companies.*
- Plan for a workshop in the spring of year 2000.

## Result of all questionnaires sent back

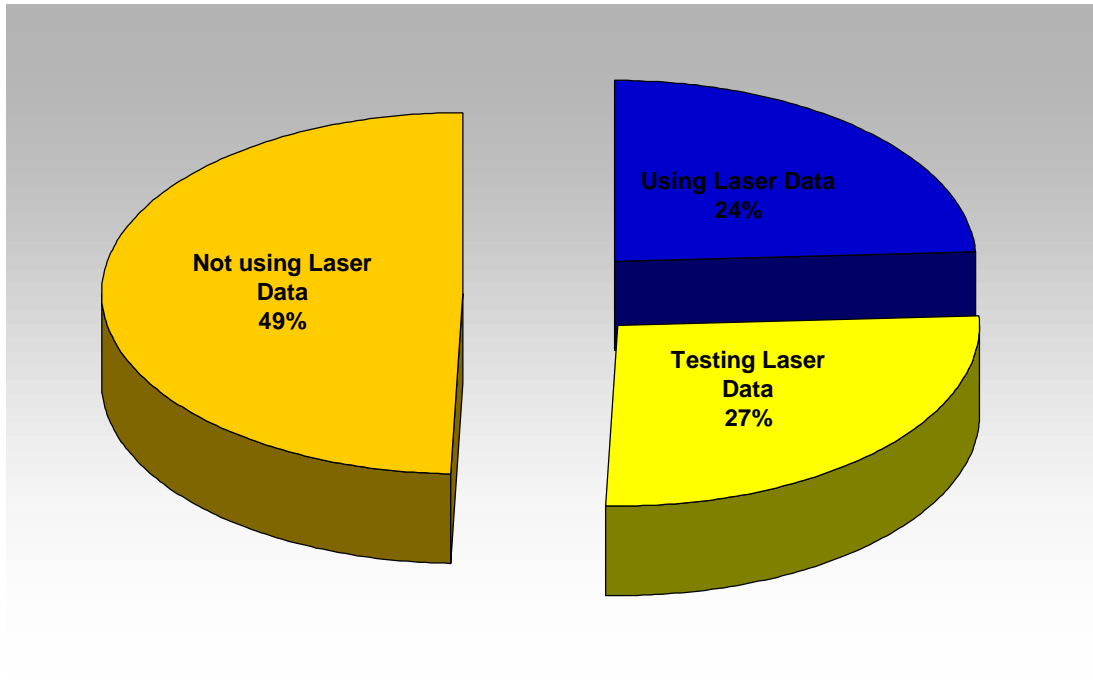
**Table 1**



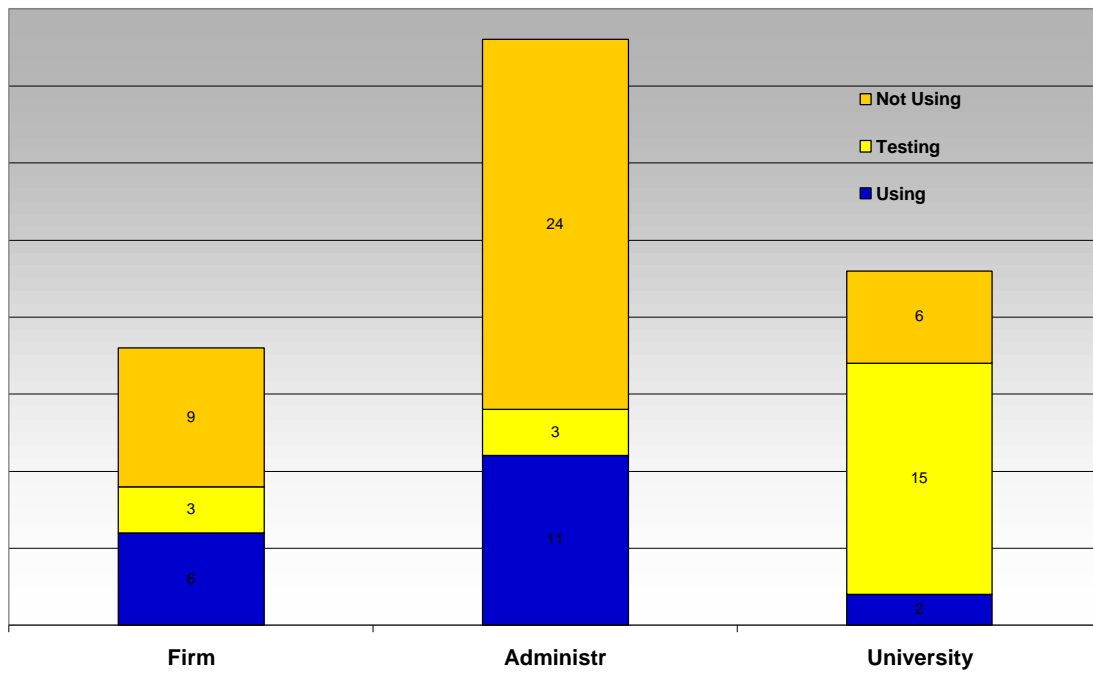
**Table 2**



**Table 3**



**Table 4**



## Results of organisations using laser data

Table 5

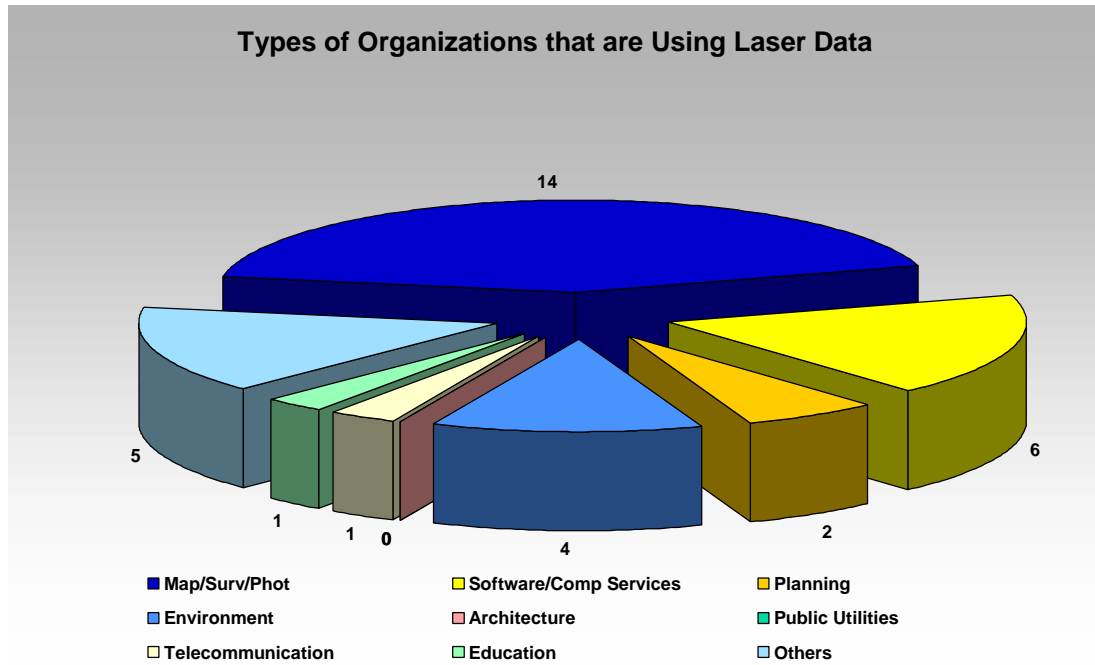
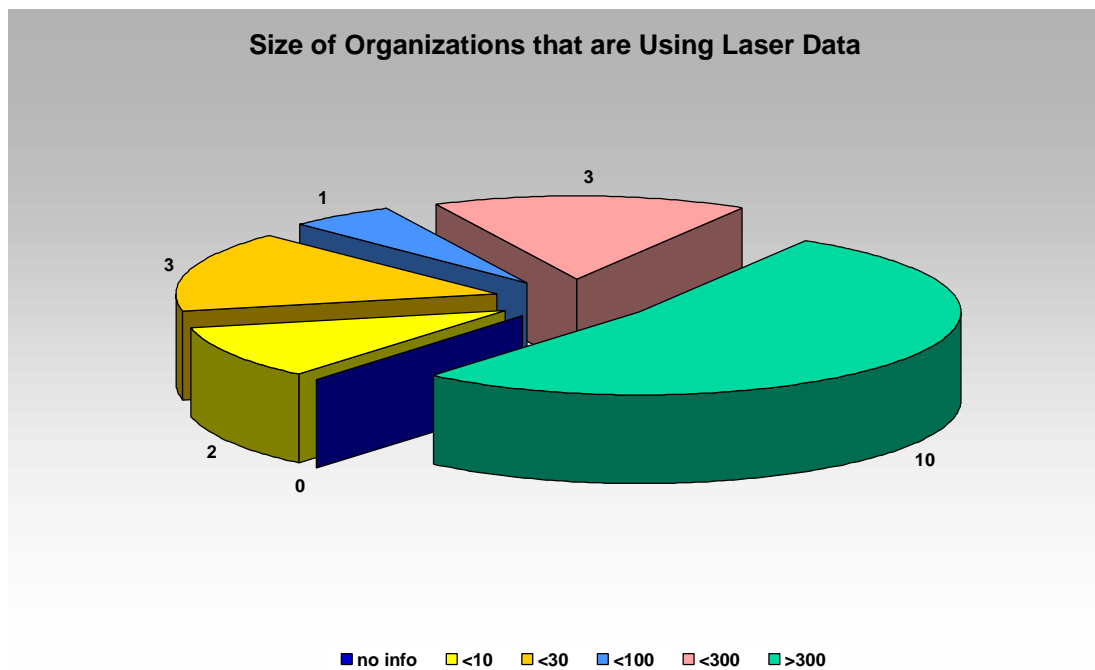
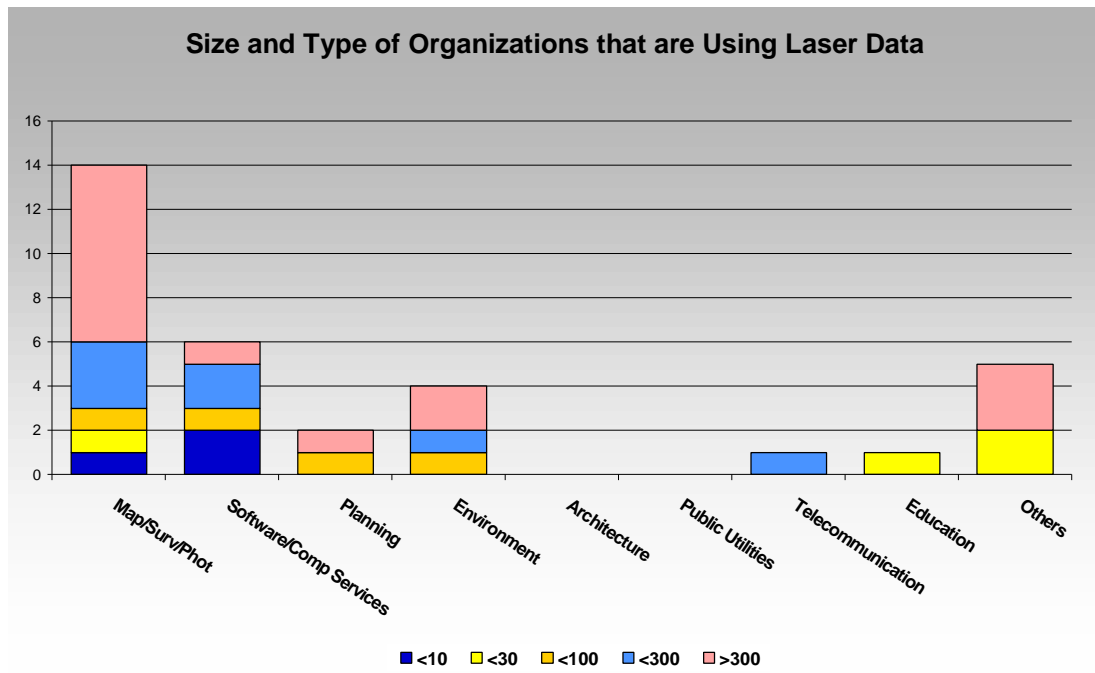


Table 6





**Table 7**



**Table 8**

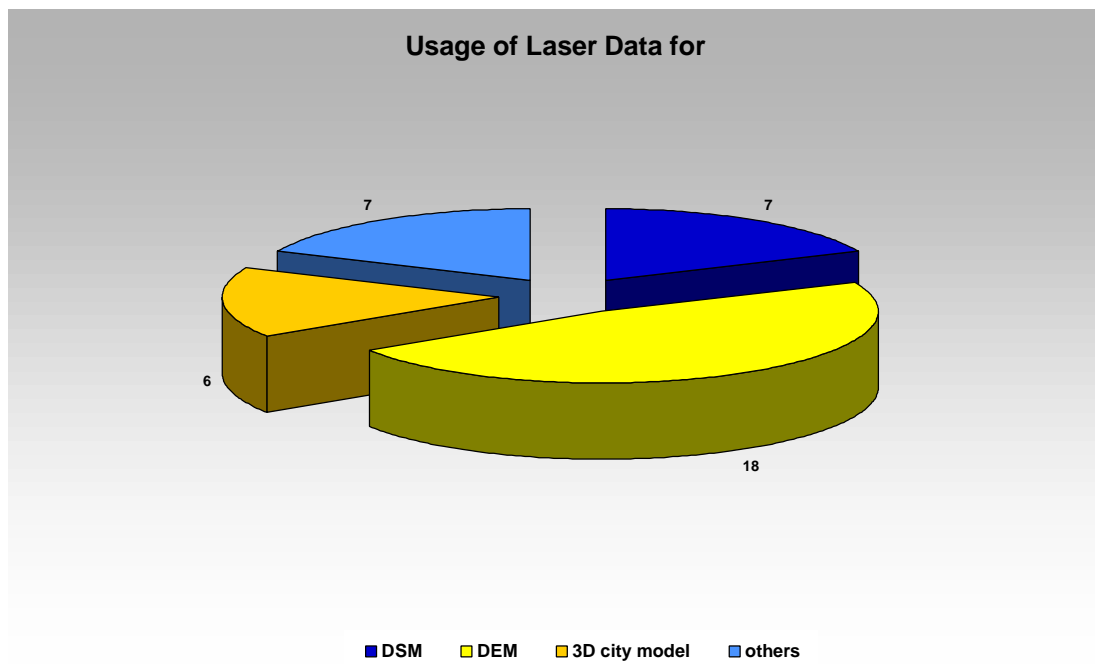




Table 9

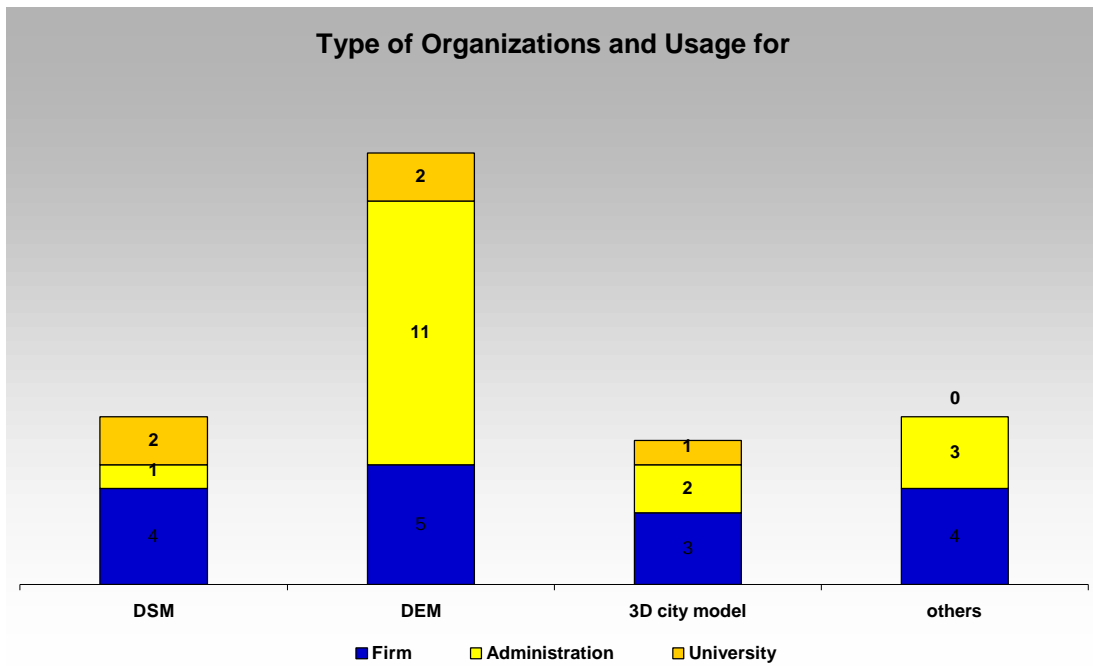


Table 10

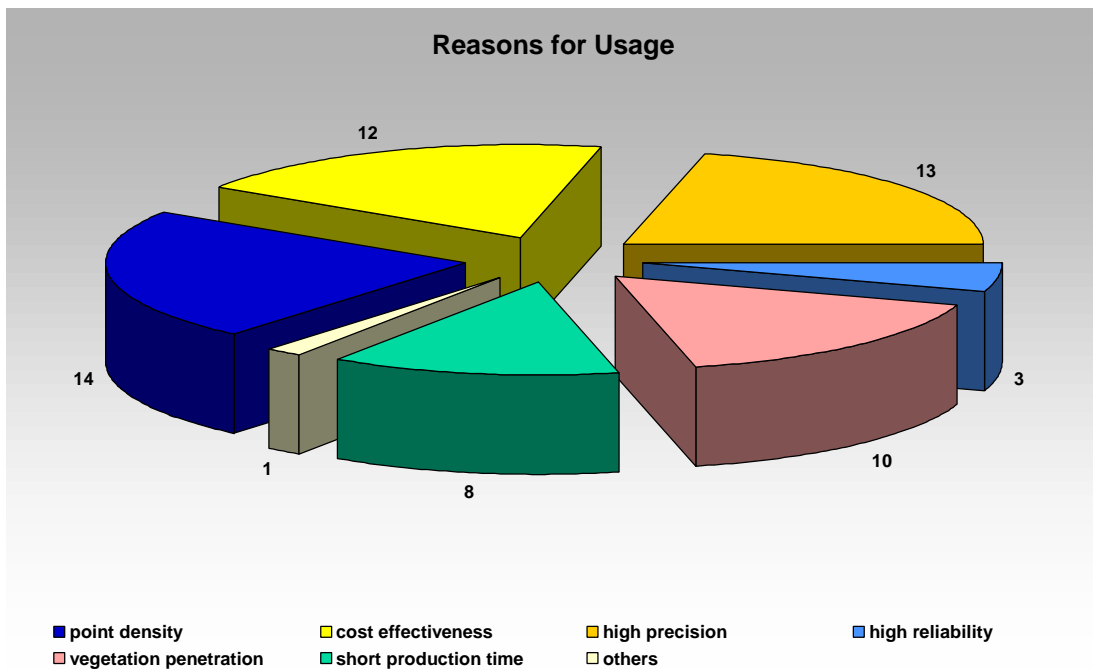


Table 11

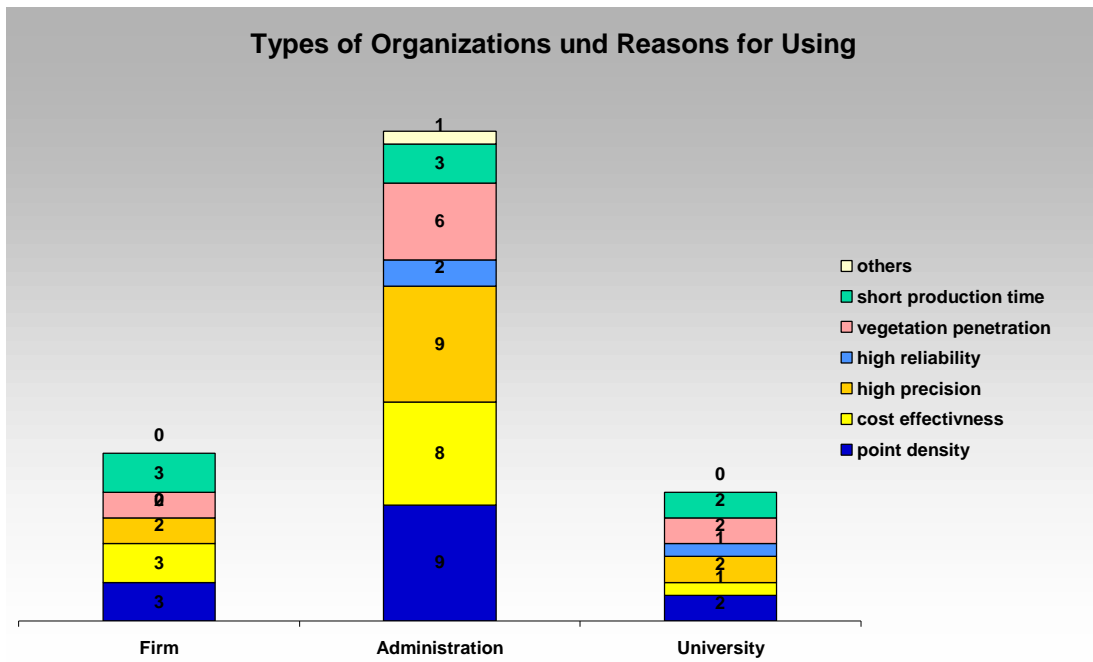
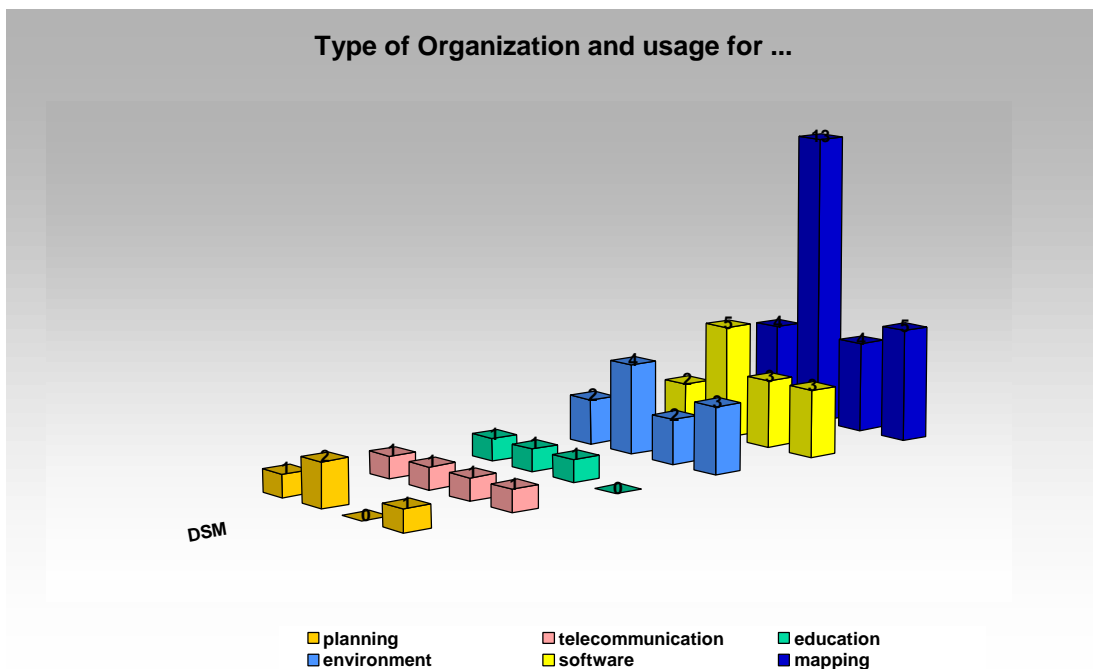


Table 12



## Results of organisations testing laser data

Table 13

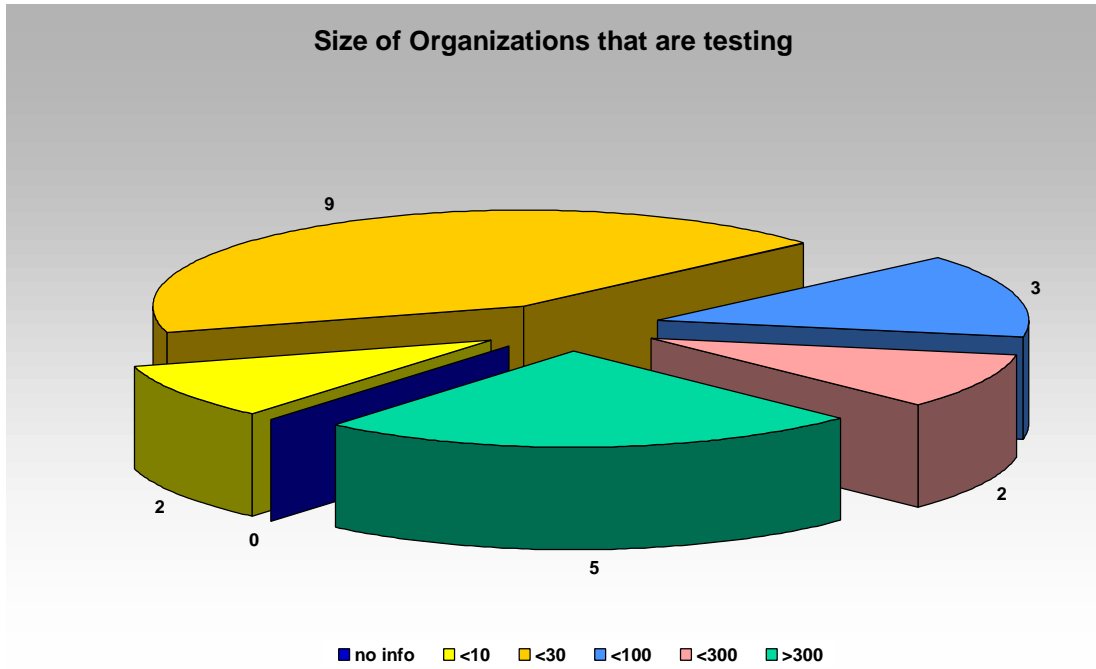
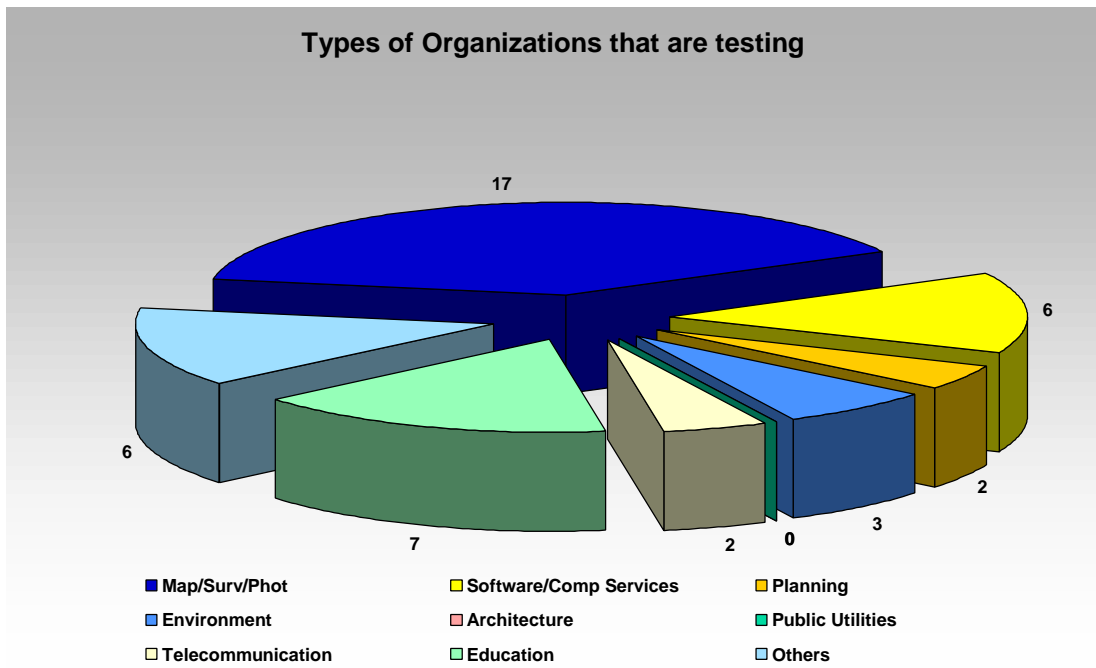
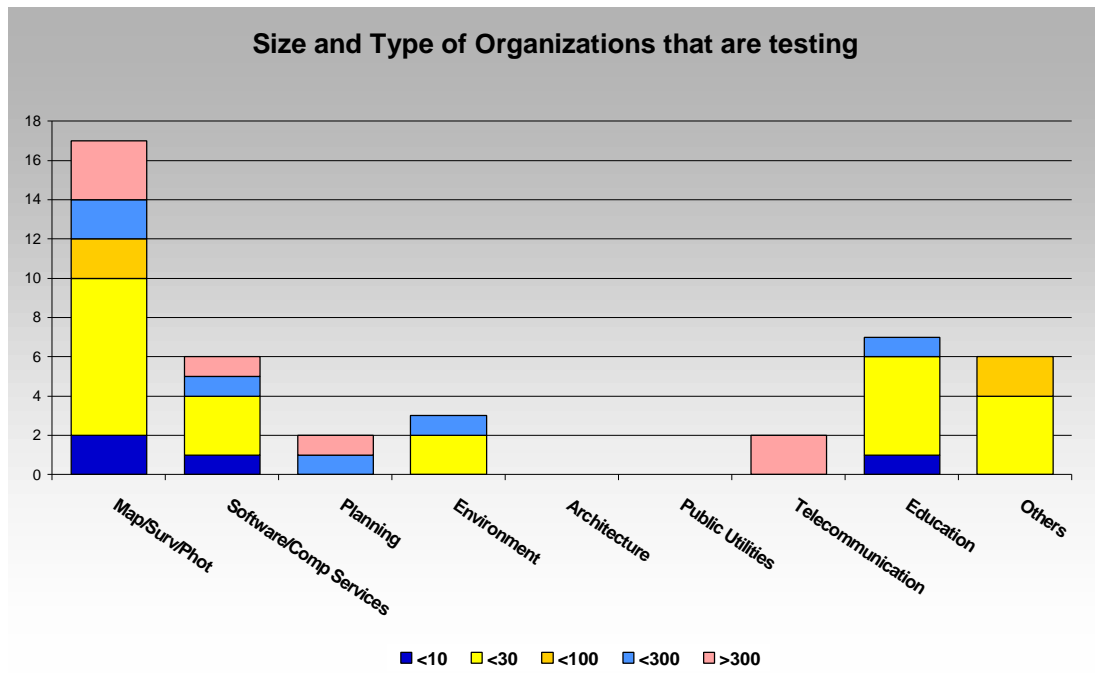


Table 14



**Table 15**



**Table 16**

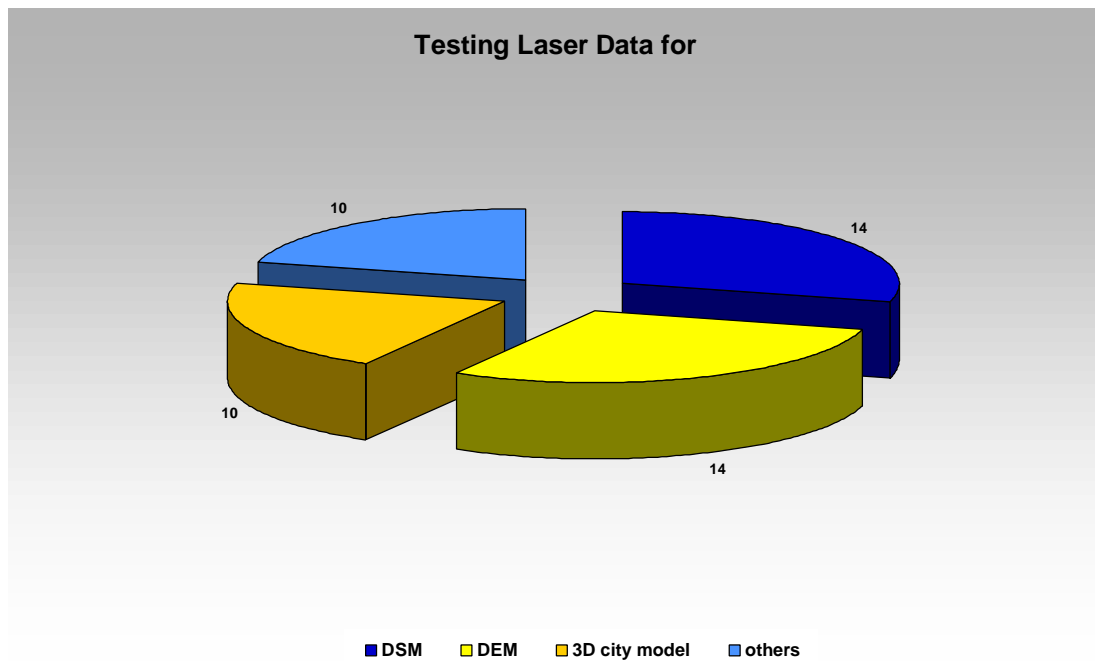


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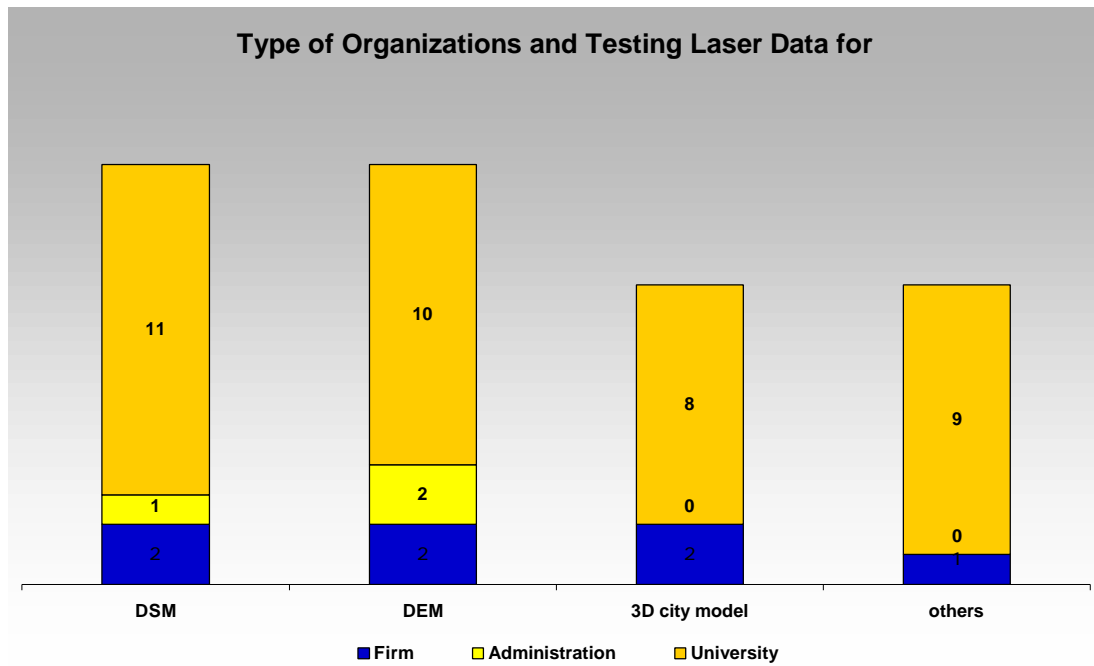


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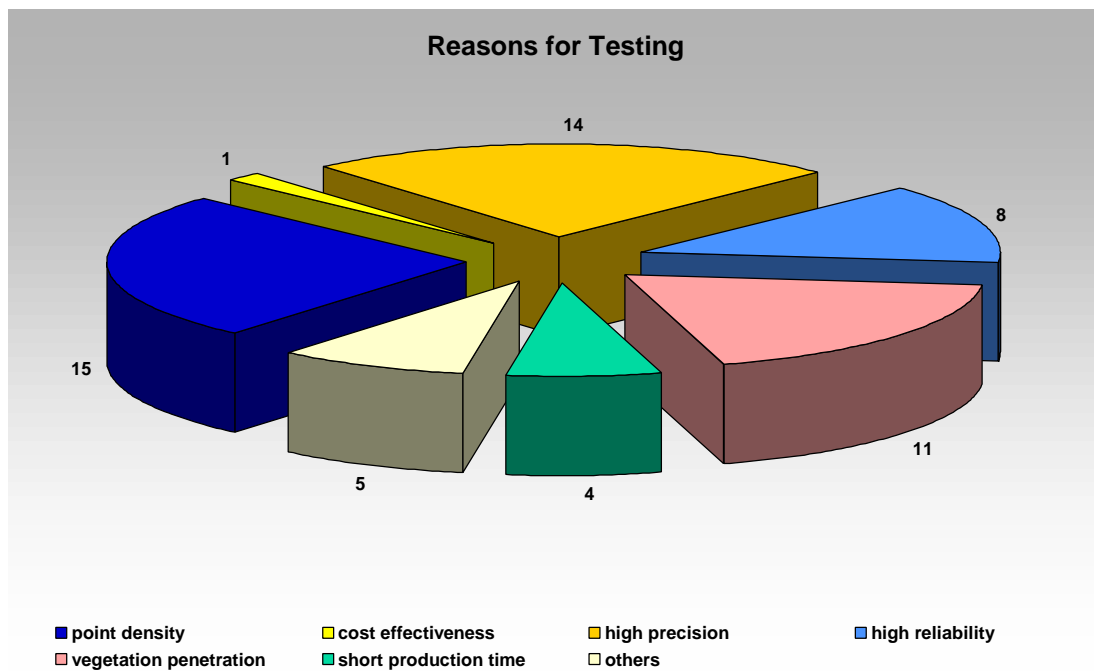


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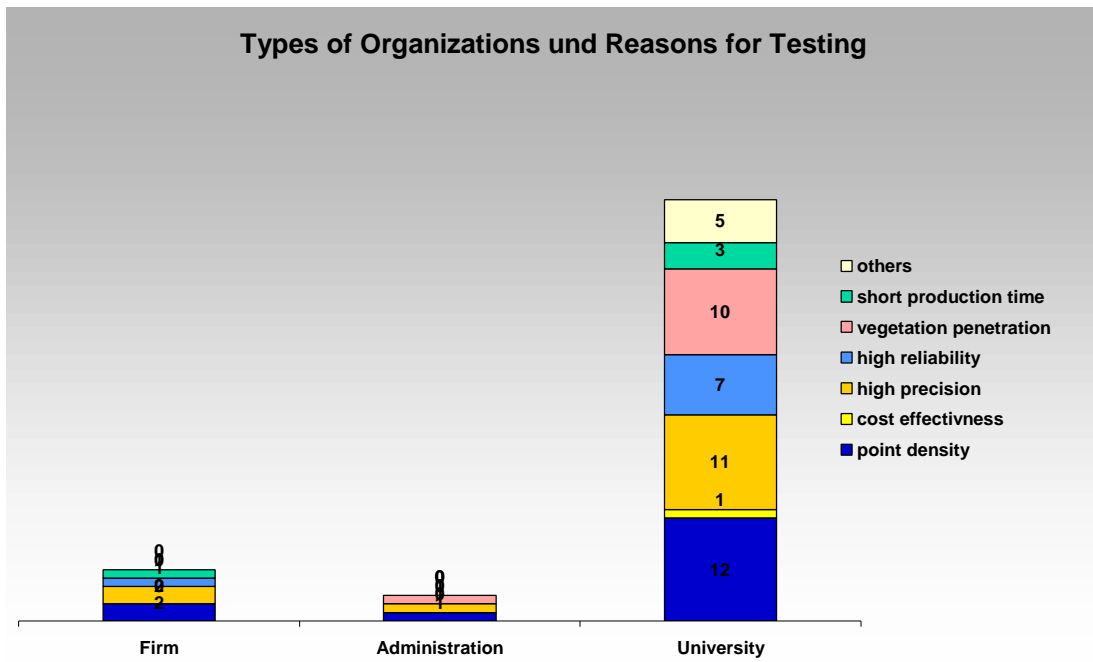
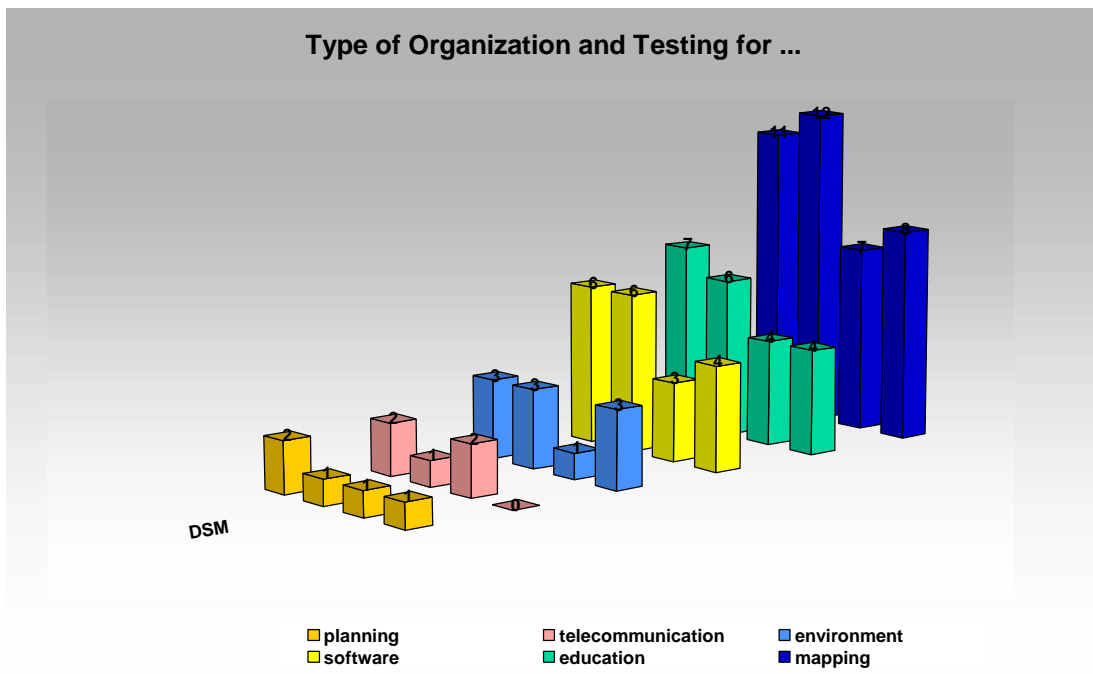


Table 20



## Results of organisations not using laser data

Table 21

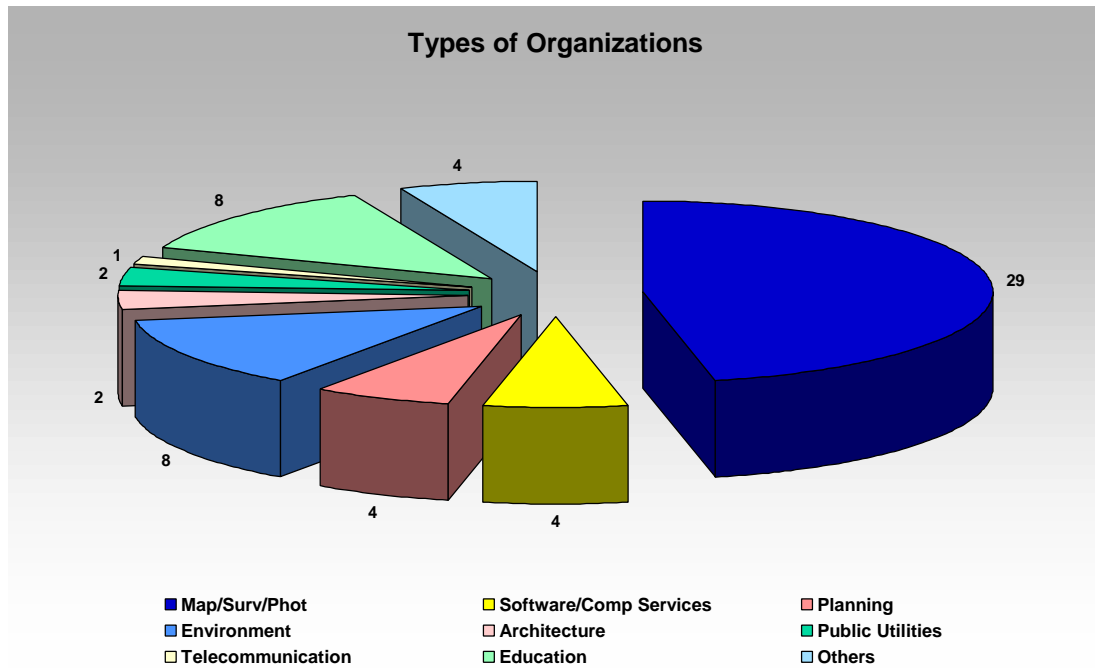


Table 22

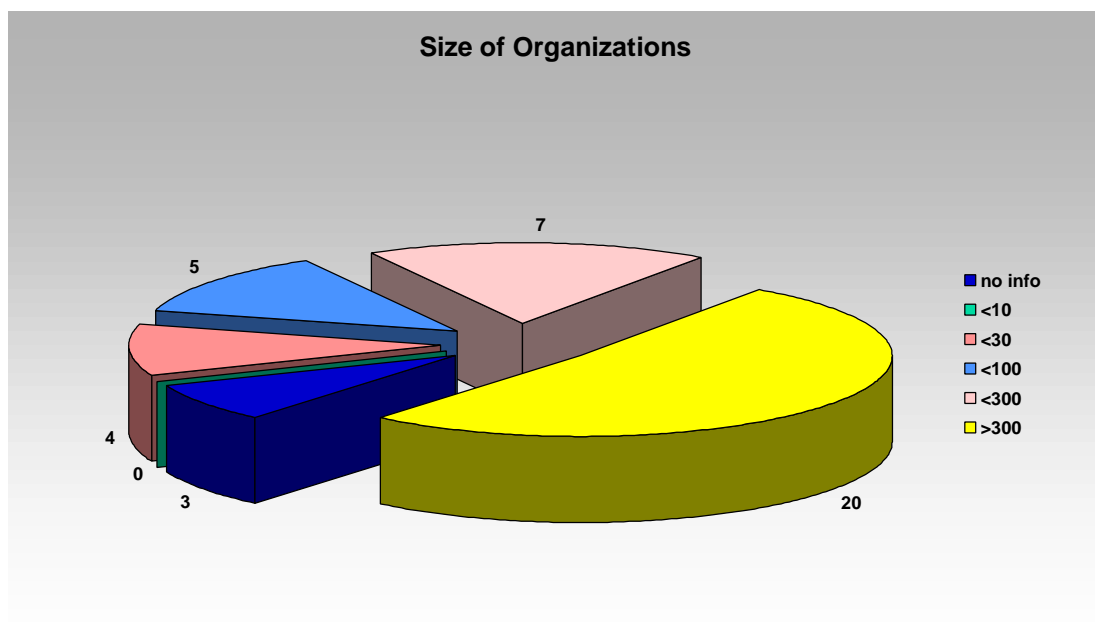






Table 23

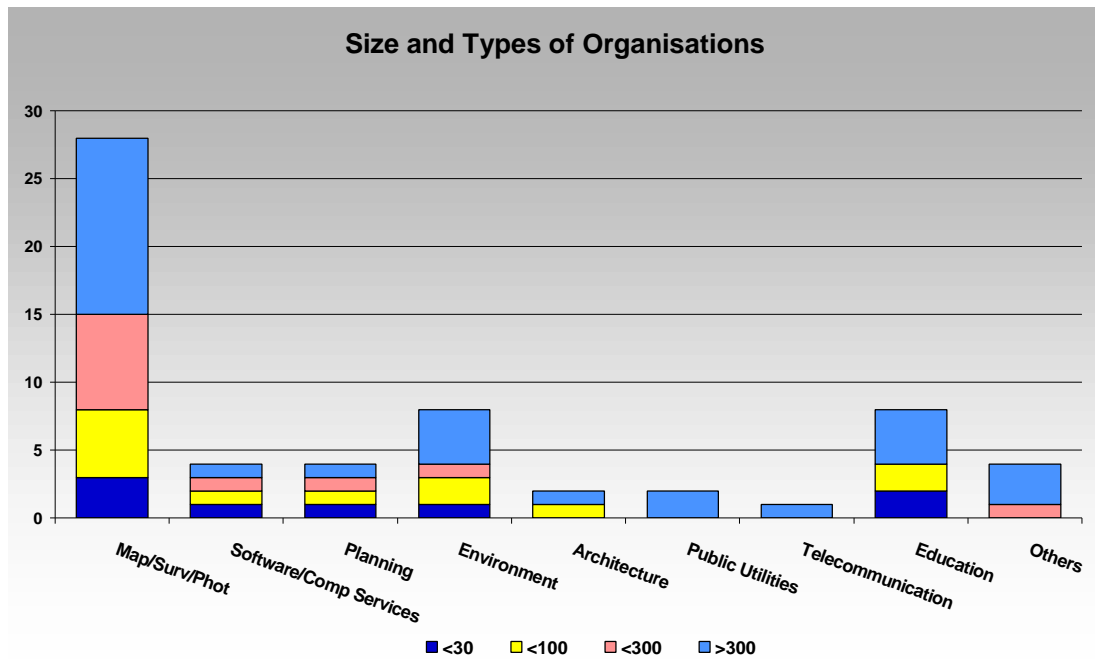


Table 24

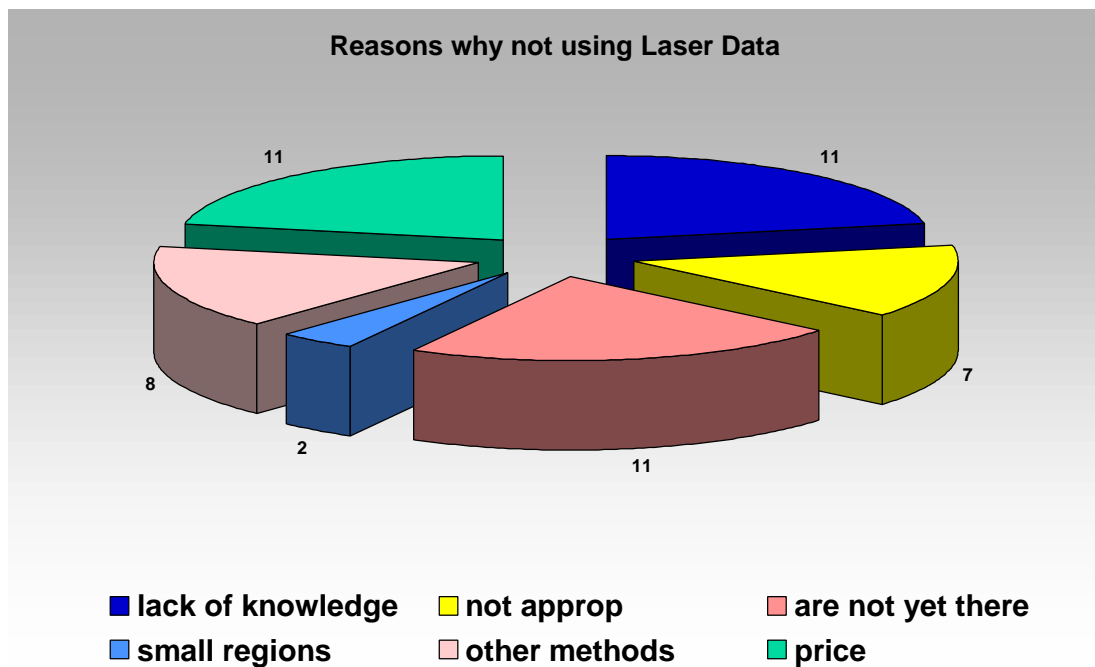


Table 25

