The Use of 3D and 4D CAD Systems to Reduce Error Rate and Reworking in Construction

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Problems with current Documentation Systems

- Misunderstanding the intent of documents is identified as a source of a significant amount of rework in construction.
- Visualizing the transition from 2D technical drawings to 3D built objects is something that many people find difficult.
- Both 2D and 3D documentation systems neglect the element of time. How long will it take? In what order are things to be built? How do these variables affect cost?

Awareness in Australia of possible CAD innovations can be tested by survey

- Architects, Building Designers, Quantity Surveyors, Engineers, Builders and Building Surveyors each have differing relationships to the documentation process and therefore differing perspectives.
- Do the professions vary in their perception of the need for change? Do their perceptions relate to their own familiarity with 3D and 4D CAD systems?

Survey Details

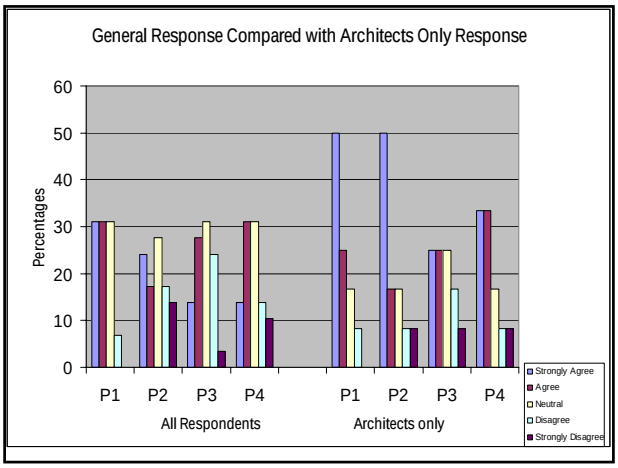
- Survey was restricted to NSW.
- 87 sent out and 29 complete responses were received for an acceptable response rate of 33%.
- 15 propositions on 3D and 4D CAD were presented.
- Opinions in the form of general comments were also sought.

General Survey Response

Proposition	Total Positive	Total Neutral	Total Negative
1. 3D CAD is the way of the future	61%	32%	7%
2. 3D CAD is my preferred form of documentation now	42%	29%	29%
3. 3D CAD leads to fewer drafting errors	39%	32%	29%
4. 3D CAD is easier for builders	42%	33%	25%
5. 3D CAD leads to fewer construction mistakes	36%	28%	36%
6. 3D CAD makes costing more accurate	29%	42%	29%
7. 3D CAD is useful for construction scheduling	50%	36%	14%
8. 3D CAD is useful for training design office staff	61%	32%	7%
9. 3D CAD is useful for training management staff	57%	32%	11%
10. Animated (4D) documentation would be useful for training workers	61%	22%	17%
11. 4D CAD would be useful in construction planning	54%	36%	10%
12. Accurate 4D CAD would make estimating more precise	29%	39%	32%
13. Residential building is resistant to increased computer use	29%	39%	32%
14. My current work method will not change in the next ten years	25%	18%	57%
15. The next ten years will see increased use of computers in residential building	86%	14%	0%

Survey Analysis

- Overall response more negative than anticipated.
- On the matter of whether accuracy would be improved by 3 & 4D CAD there was a three way split between positive, neutral and negative responses (P5, 6 & 12).
- Enthusiastic response about the use of 4D CAD in training (P8, 9 & 10).



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Survey Comments

- Several respondents stressed that it is the operator's level of construction knowledge that counts not the drawing system that is being used. "Garbage In – Garbage Out"
- Some respondents suspected that the newer CAD systems could (temporarily) mask the skill level of the operator resulting in inadequate documentation that was not easily detectable.

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Research Proposal at UWS

- Proposed study to validate the use of 3D and 4D CAD in on-site conditions.
- Practical exercise using teams of students from B. Construction Management course.
- Exercise to involve a small construction task (2nd year students) as well as inspection of the results (4th year students).
- Half of the construction teams will be given traditional 2D drawings. The other half will receive 3D CAD drawings plus a 4D animation of the construction task.

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Does the format of documentation affect the quality of the built product?

We will measure:

- Time taken to completion (self assessed by participants).
- Errors detected by inspectors (final year students).
- Experienced assessment of work quality.