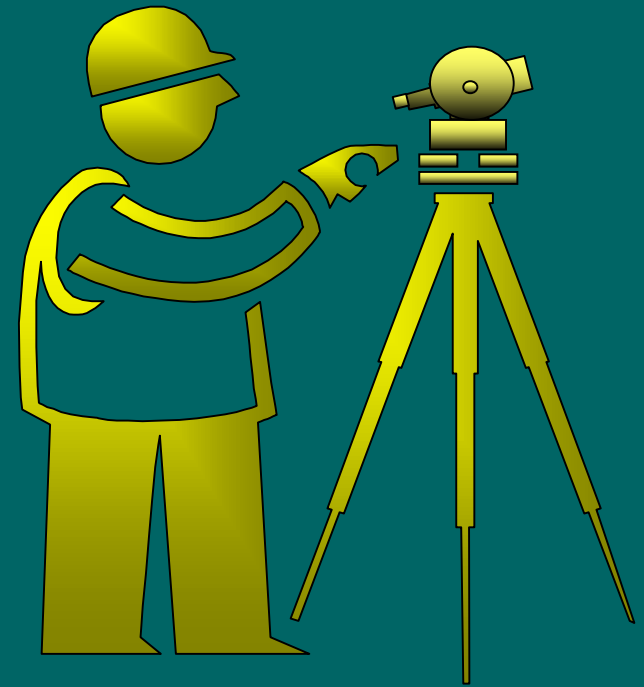


Setting Out Errors

Setting out errors are highly visible and can be very costly.

Sources of error must be analysed, and eradicated.



**Your reputation and self esteem
will suffer if you set out wrongly!**

Topics

Using current information

Calculations

Checking instruments

Check each instrument set up

Setting out in isolation

Self checking procedures

Accuracy versus speed

Record keeping

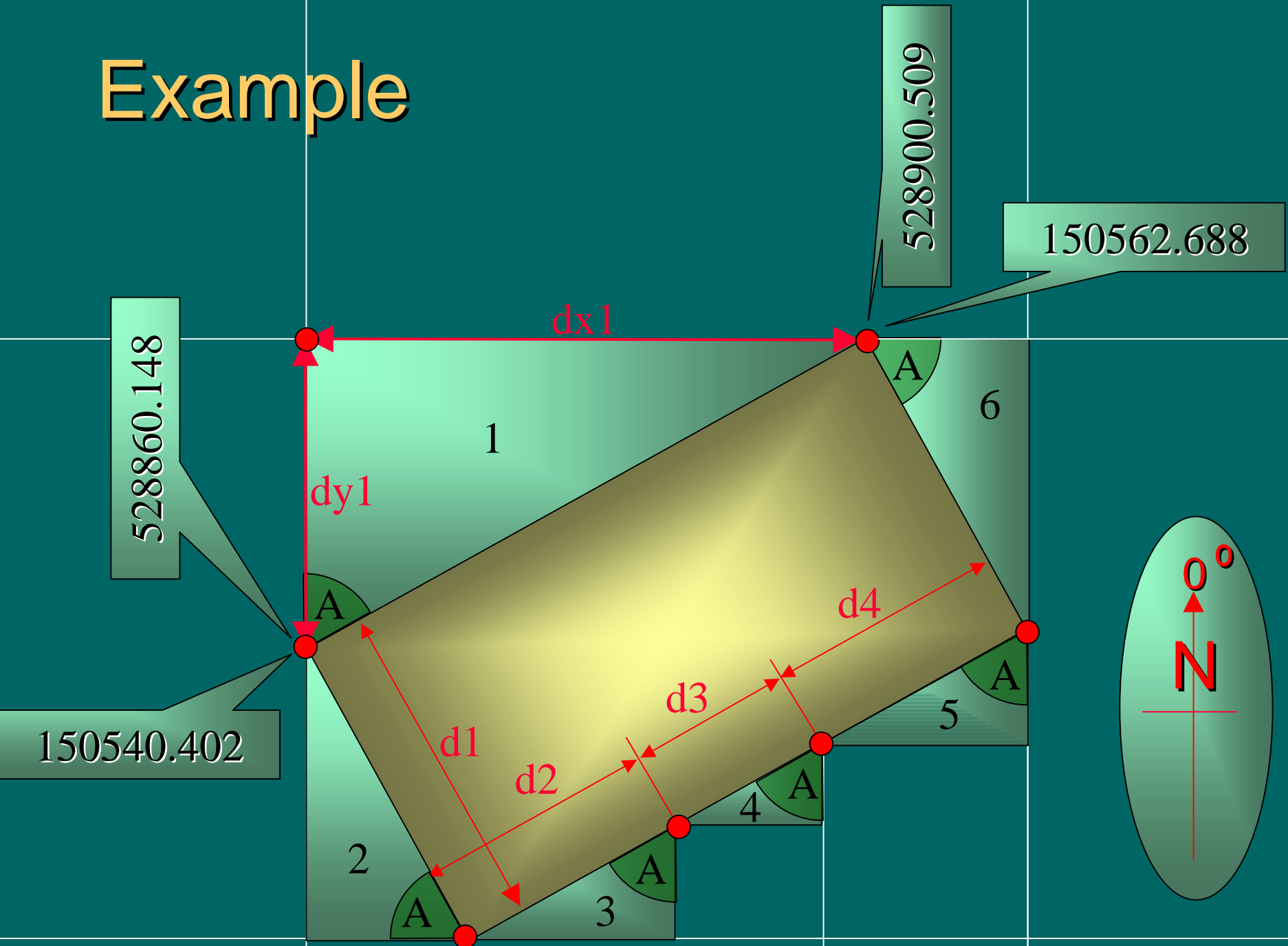
Use current information

1. Your site must have an up-to-date drawing register.
 2. Check that you are using current drawings.
 3. Your site must have an up-to-date datum and SOP register.
 4. Check that you are using current values.
-

Calculations

1. Solve calculations graphically if possible. The human brain works better with pictures as opposed to numbers. [AutoCAD](#) drawings can be scaled on screen!
2. Don't forget [spreadsheets!](#)
3. If using a calculator is unavoidable, arrange for the calculations to be self-checking i.e. make all results dependant on the previous calculation rather like a level circuit, or a closed traverse.
4. Do not round intermediate results!

Example



Calculations continued

If using a Total Station, the built-in software can be very useful for storing coordinates and for setting out offsets, design lines, etc. However be aware that: -

1. The stored coordinates must be valid.
 2. The results from resection programmes are critically dependant on the intersection angles even if distances are measured.
-

Check your instruments daily

1. Check your Levelling instrument/laser on a test bay ensuring that backsight and foresight are dramatically different. (say 1m. and 25m). Do this before you use the instrument.
 2. Check both horizontal and vertical angles, (both faces), plummet and bubbles, on your Theodolite or Total Station before use.
-

Instrument check continued

4. Before observing distances with a Total Station or EDM, measure a known distance using the prism that you intend to use for the day's work.
5. You **MUST** record the results of your instrument checks and if adjustment is carried out you must repeat the checks and record those results as well.
6. If you change from a standard to a mini prism, check that the slope distance obtained electronically, agrees with the taped distance.

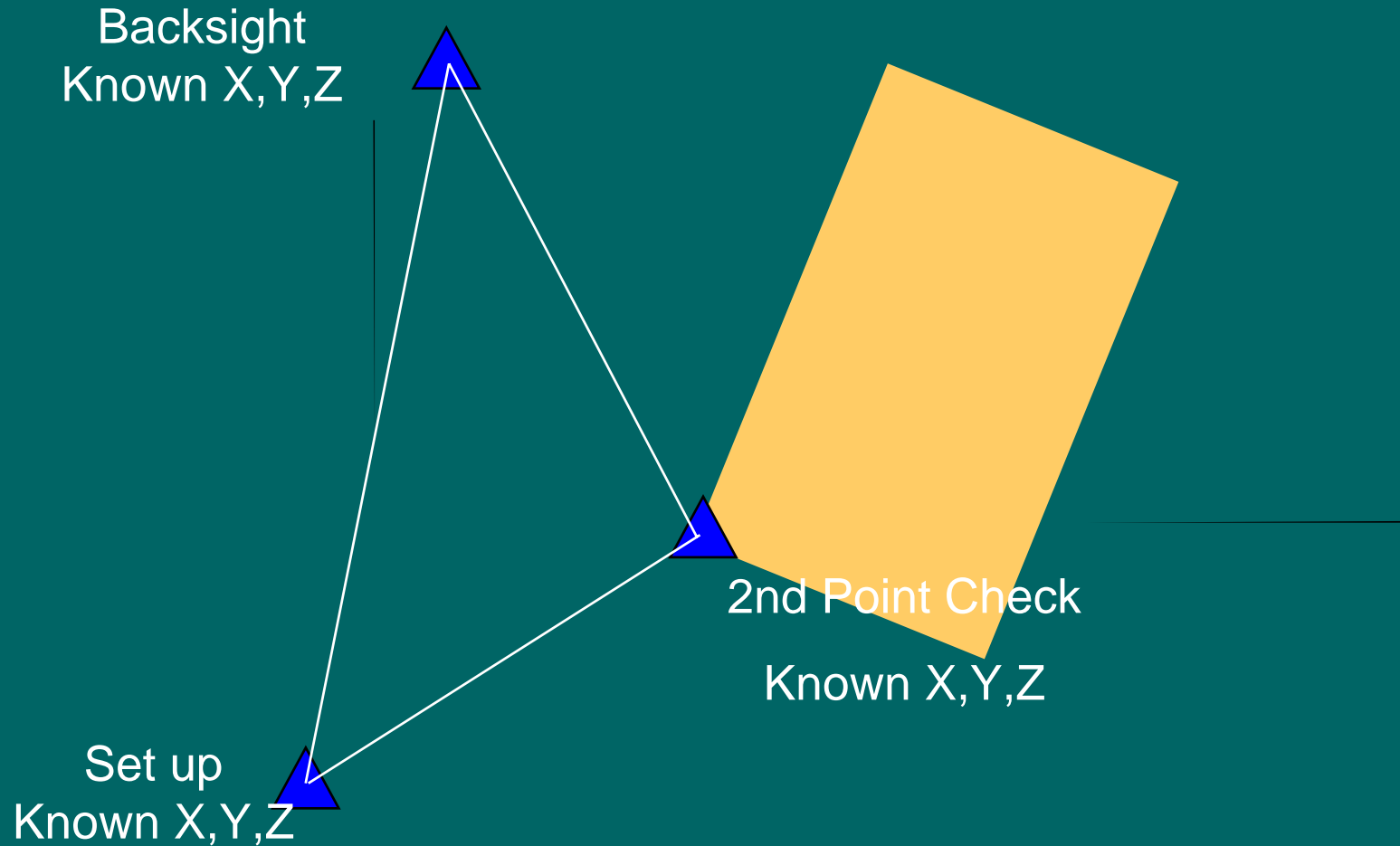
Check each instrument set up

1. When levelling do not rely on a single backsight to determine the collimation height.
2. Remember that there are no checks on intermediate sights – if you misread the staff your circuit may very well close, but an intermediate misreading will give you the wrong elevation at that point.

Set up checks continued

1. When setting up a Total Station or EDM, it is recommended that the 3D coordinates of the backsight are measured and compared with the theoretical values, and also a second point whose coordinates are known. The values observed must be recorded.
2. A permanent backsight or RO must be available for checking the whole time that any SOP is occupied.

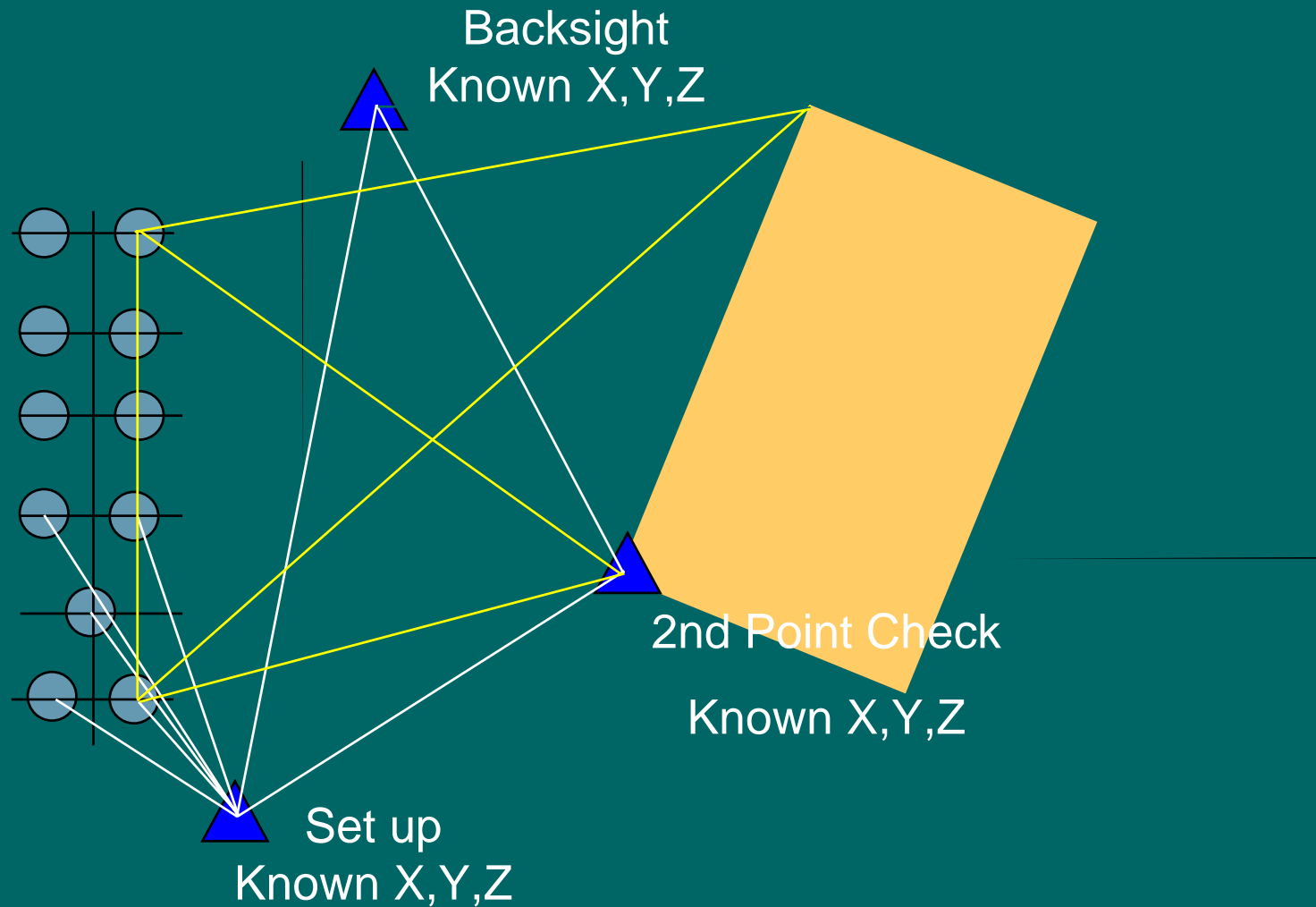
Set up checks continued



Do not set out in isolation

1. After you have set out you MUST check the R.O. or backsight, then survey and record the coordinates of all the points that you have just set out.
 2. ALWAYS check your setting out by relating to existing features, and record your checks.
-

Do not set out in isolation



Accuracy versus speed

1. Accuracy and reliability are paramount.
2. There is no point in building something in the wrong place because of pressure of time.
3. You must have confidence in your setting out, and this confidence is founded on systematic working procedures, and sufficient time to do the job.
4. Timely setting out should be based on project planning – not on hurried procedures.

Setting out/Survey marks

1. Marks should be as permanent as possible, e.g. masonry or pipe nails in concrete slabs.
2. Pegs in soft ground should be at least 50 X 50 X 500, concreted and labelled, and should be regarded as liable to movement.
3. Line and level marks must be clearly visible, clearly labelled, and consistent with similar structures.
4. Do not use offsets smaller than 500mm.
5. Always mark the centre lines of holes and columns.

Record keeping

It is essential that you have **evidence to prove** that every setting out or surveying activity that you have undertaken has been done correctly. You can only do this if you have complete contemporary records that you **or others** can access and understand at a later date.

The obvious place for these records is in your field books, which must be kept clean, in date order, and archived when full.

Record keeping, continued

Field book recording should follow the sequence below:

1. Each page should be titled, (site & area), numbered, dated, and referenced, if appropriate, to previous relevant work.
2. Start information including drawing numbers, and any notes and sketches, and assistants names.
3. Instrument checks and any adjustments.
4. Set up checks to backsights and RO's.
5. Setting out observations.
6. Checks on setting out.
7. References to consequential documents.

Constant/Systematic Errors

- a. Usually arise from known natural or instrumental sources, e.g. slope of ground, incorrect temperature, refraction, instrument calibration error, wrong prism constant, plummet out of adjustment
- b. Not reduced by taking the mean of observations
- c. Each measurement is consistently too large or too small, unless the basic source varies

Residual Errors

- a. Estimating the millimetres on a levelling staff
 - b. Telescope pointing errors
 - c. Numeric accuracy in calculators
 - d. Residual calibration errors in surveying instruments
-

THE END

