Measuring Element (31) External Walls Completion. An Introductory Demonstration

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About this demonstration

This demonstration is addressed to Irish students taking measurement or quantities modules at first year or entry level of quantity surveying related programmes.

The worked example has been carried out using traditional handwritten quantity surveying processes on traditional dimension paper. It is acknowledged that, in actual practice, this would be carried out using measurement software or on-screen measurement technology. The traditional handwritten approach, however, has been retained in order to enable novice students to develop the necessary measurement skills and build confidence through direct contact with drawings and written taking off processes. In addition the presentation illustrates how the work may be laid out under typical examination conditions.

The demonstration has been kept simple in the interests of clarity but nevertheless accords with the principles of the Agreed Rules of Measurement (ARM4 – 2009) and aims to provide a foundation for the measurement of more challenging scenarios.

Measuring Element (31)
External Walls Completion.
An Introductory Demonstration

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The National Standard Building Elements

In Ireland the measurement of new building work is typically organised in accordance with The National Standard Building Elements for Design Cost Control Procedures (NSBE)(ERU, 1993) Elements are defined as ‘that part of the building, which always performs the same function irrespective of design or specification’. The object of the NSBE is to enable design teams to adopt, on a national basis, a common approach to the building process. The NSBE Elements identify what is included and excluded from each element, which helps design teams coordinate their work and allows the measurement of the work to be divided up among teams while ensuring that all aspects of the building works are fully covered in the Bill of Quantities.

Completions are defined in the National Standard Building Elements as “non-integral secondary items or work to the structure, including the completions of openings in the structure”.

This demonstration deals with the first element within the Structure Completions group - Element (31) External Walls: Completions within openings
The Location Drawings

FLOOR PLAN

TYPICAL SECTION
External Walls Completion

External Walls Completion comprises the following:
• Doors, windows, frames and composites of these.
• Completions of all other openings in external walls.
• Ironmongery.
• Glazing.
• Shutters, awnings and canopies.
• Decoration to the forgoing.

This element excludes the following
• Sills and lintels. These are measured in (21) External Walls.
• Doors and windows integral with walls, (for example where these form part of a curtain wall system).
• Continuous screens and continuous shop-fronts having the nature of walls.

Windows and external doors for domestic residential projects can be manufactured from a variety of materials, most notably wood, metal or PVC coated aluminium extrusions.

This example takes a ‘traditional’ approach to measuring hardwood glazed external doorsets and windows and associated works in connection therewith across three ARM4 work sections: woodwork, glazing and painting. This approach has been adopted for demonstration purposes only, as it is becoming less widely used in practice.

The author acknowledges that it is standard practice for such windows and external doors to be manufactured off-site pre-glazed and pre-finished and fitted with the ironmongery specified by the architect; an alternative which greatly simplifies the measurement of this element of work.
The Details
Drawing 31-2

<table>
<thead>
<tr>
<th>Reference</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTA</td>
<td>1800x1200</td>
</tr>
<tr>
<td>WTB</td>
<td>900x1200</td>
</tr>
<tr>
<td>WTC</td>
<td>1200x1200</td>
</tr>
<tr>
<td>D1</td>
<td>1000x2100</td>
</tr>
<tr>
<td>D2</td>
<td>1500x2100</td>
</tr>
</tbody>
</table>

**Notes**
Allow 12mm rebates for glass and sash seating
The Specifications

WOODWORK
Iroko
Secondfixings
- 200x25mm bullnosed edged window board. Allow 50 mm nibbed end

External doors and associated frame sets
- as drawing 31-1 fixing with 125mm long ‘Hilti’ or equal approved door bolts
- Double doors to be 900 and 500mm wide respectively.

Windows
- as drawing 31-1 details as drawing 31-2 including standard ironmongery, fixing with galvanised iron frame cramps.

Ironmongery
- Prime Cost Sum - £500 supply only for external doors.
- Fix only ironmongery: cylinder night latch; pair flush bolt; rebated mortice lock; pair of lever handles; letter plate and weather bar.

GLAZING
Hermetically sealed double glazed units comprising 4mm sheet glass to both panes with 10mm Argon filled cavity; glazing in clear mastic silicon sealant; securing with glazing beads bedding in inert cushion strip.
- Obscure glass to bathroom window and front door.

PAINTING AND DECORATING
- 3 coats Ronseal clear wood varnish internally.
- 3 coats Ronseal yacht varnish externally.

Order of Measurement
The order of measurement of this particular work element varies among individual quantity surveying practices. Some practices measure in accordance with the ARM sequence, others measure the composite items first (windows and external doors and screens) in order to emphasise their importance within this element and then arrange the remaining work in ARM4 sequence. Individual practices may also begin this element with works which are the subject of a Prime Cost sum(s).

Note that standard UK measurement practice (the BCIS Elements) separates doors and windows into two distinct elements.
Ironmongery

The supply and fixing of units of ironmongery is **enumerated** giving a full description of the various items. Where ironmongery is fixed to backgrounds other than timber, the nature of the background shall be stated. Items of ironmongery may be described by the set where appropriate and this shall be stated in the description. Rates for ironmongery are deemed to include the following.

- Screws, bolts and the like;
- Labours on timber and to receive units, and
- Fitting and hanging doors, windows and like items.

The manufacturer of butt hinges is seldom specified, but the architect may require that their source is approved.
GLAZING
Glazing is measured in accordance with section P of the ARM. The following information is required for general glazing applications.

• Location Drawings – i.e the general arrangement drawings.
• Kind, quality, size and thickness of glazing materials.
• Kind and quality of glazing compound.
• Method of glazing (such as with beads and screws).
• Nature of frame or surround

General Rules
Panes of irregular shape shall be measured and defined as the smallest rectangle area from which such irregular shape can be obtained.

Labours on glass shall be grouped with the glass to which they relate.

Raking cutting is deemed to be included.

Sealed glazed units
Are measured in square metres and classified as double or multiple, stating number of panes. Irregular shaped units and/or curved units are measured separately.
PAINTING AND DECORATING

The measurement of painting and decorating is regulated by section Q of ARM4.

Painting specifications include the following information:
- Preparatory work to base
- Kind and quality of materials
- Number of priming or sealing coats and undercoats
- Number of finishing coats stating the surface finish
- Abrasive or other treatment applied between coats.
- Method of application where not at the contractor's discretion

General Rules related to this demonstration
- The work is deemed to be internal. External work shall be given separately.
- Nature of base shall be stated in description.
- Work shall be measured on the exposed face except for glazed surfaces which shall be measured as plane surface across frames and glass.
- Work ≤300mm girth isolated from similar work shall be so described.

Deemed to be included related to this demonstration:
- Rubbing down between coats with glass or sand paper.
- Cutting in next glass.
- Opening edges.

Painting Classifications related to this demonstration:
Painting is categorised in 13 separate work classifications which include second fixings (window boards), glazed doors and frame sets, and windows.
THE WORKED EXAMPLE

WOODWORK

The specification information to be provided for carpentry and joinery identifies the particular timber species/type (Iroko) stating the quality, preservative treatment, surface finish, fixings and jointing.

Window Boards

Window boards are a separate sub-classification within the second fixings category. They are measured in linear metres including details of any mouldings (bullnose edge). Other general woodwork rules are also applicable here.

• Fixings other than nails to be stated in descriptions.
• Fixings to backgrounds other than timber to be stated in the descriptions.
• Pelleting where required to be given in the descriptions.

The length of the board is measured to its extreme length and comprises the width of the structural opening and includes a 50mm nib at both ends. - Ends, angles intersections mitres, splays, and the like are deemed to be included.
Composite items;
These are enumerated and given with a detailed description

Doors with associated frame sets
Doors and associated frame sets are enumerated.
A detailed description is provided stating the overall dimensions and the cross section size and moulding of each component where not shown on the accompanying drawings. These are shown on Drawing 31-2. Member sizes will normally be nominal sizes unless stated as finished sizes.
Fixing of all metalwork, ironmongery and the like included in the description is deemed to be included in the rate(s).
In this demonstration the glazing is taken separately. Glazed doors usually come with matching glazing beads included in the description. It is normal to state that the glazing beads are to be taken off and refixed.

Windows
Windows are enumerated and described in detail. This is usually done by referencing them to a drawing such as a window schedule, building elevation or bill diagram.
Window descriptions state the overall dimension, - note the waste calculation performed to establish the overall thickness of the window.
Windows (Continued)
The remaining windows are taken for in turn.
Ironmongery

Prime Cost Sums are often used to cover the supply of ironmongery. In this instance **€500** has been provided (for demonstration purposes only) for the ironmongery to the front and rear doors.

The rules governing prime cost sums are set out in Section B (Preliminaries) of ARM 4. Section 3.2 states that ‘Goods and materials which are required to be obtained from a nominated supplier shall be given as a Prime Cost Sum. The name of the supplier to be nominated shall be given (if known).

An item shall be given for any **profit** required by the Contractor.

An item shall be given for **other charges required by the Contractor** associated with the employment of each nominated supplier.

Fixing goods and materials shall be given in accordance with the appropriate sections of these Rules. Taking delivery, unloading, storing and hoisting the goods and materials and returning packing materials to the nominated supplier carriage paid and obtaining credits therefore shall be deemed to be included with the items for fixing. Particulars shall be given where the Contractor is required to pay the costs of conveying goods and materials to the site and/or of any special packing or similar requirements.

It is good practice to compile an ironmongery schedule when measuring a complete building, if this has not already been prepared by the architect. This simplifies the task of measuring the work and reduces the risk of error.
**Fixing Ironmongery**

Where ironmongery is supplied by a nominated supplier, a separate fixing item must be taken for each item supplied. Each is **enumerated**, stating the background where fixed to background other than timber.

Items of ironmongery may be described by the set where appropriate and this shall be stated in the description. Rates for Ironmongery are deemed to include the following.

- Screws, bolts and the like
- Labours on timber and to receive units
- Fitting and hanging doors, windows and like items.

**Note.** In practice ironmongery is typically fixed at the joinery during the manufacturing process. In these cases the ironmongery is usually included in the descriptions of the particular composite item and does not need to be measured as demonstrated here.

<table>
<thead>
<tr>
<th>Ironmongery Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder night latch</td>
<td>1 Nr</td>
</tr>
<tr>
<td>Rebated mortice lockset</td>
<td>1 Nr</td>
</tr>
<tr>
<td>Front door (1)</td>
<td>1</td>
</tr>
<tr>
<td>Back doors (1)</td>
<td>1</td>
</tr>
<tr>
<td>Letter plate (1)</td>
<td>1</td>
</tr>
<tr>
<td>Lever handles (1)</td>
<td>1</td>
</tr>
<tr>
<td>Weather bar, 900 mm fixing to concrete</td>
<td>1</td>
</tr>
<tr>
<td>Flush bolts</td>
<td>1</td>
</tr>
<tr>
<td>Weather bar, 1400 mm long fixing to concrete</td>
<td>1</td>
</tr>
</tbody>
</table>
Accessories, Sundries and Fixings

The accessories category (J84.2) comprises water bar, dowel bar, **straps and hangers**, sash weights, and like items. These require a detailed description and are **enumerated**. Installation including forming recesses and the like in all materials to receive the items is deemed to be included.

Note the water bars to the doors have been supplied and fixed under the ironmongery heading above.

The fixing cramps to the four windows have been measured under the straps and hangers sub classification.

The sundries category (J84.3) comprises bedding, pointing, and, **bedding and pointing** are measured in **linear metres** stating the width and the thickness involved. The category also comprises seals and intumescent seals both requiring a detailed description to be provided. Where pointing is to both sides this shall be given in the description.

Here the 75mm width refers to the frame width windows and the 100mm to the door frame.
Seals are also measured in **linear metres** giving a detailed description provided. In this example air tightness tape has been measured to the perimeters of the structural openings of the windows and the door frames – these have been copied down from the bedding and pointing calculations on the previous page.

The fixings category (J84.4) applies where the fixings are not otherwise included in the descriptions. In this demonstration the fixings have been specified by the Architect and have been specifically excluded in the descriptions of the door sets.

Fixings are sub-categorised as either shot fixings or drilled fixings. Drilled fixings require a detailed description to be given, stating the nature of the background and are **enumerated**.
GLAZING

Glazing specifications are required to set out the kind, quality, size and thickness of glazing materials; the kind and quality of glazing compound; the method of glazing and the nature of frame or surround.

This demonstration deals with sealed glazed units which are measured in square metres in accordance with rules under section P130.5. Units are classified as double or multiple, stating number of panes. Irregular shaped units and/or curved units are measured separately.

The glazing beads are normally included with the joinery items with the glazed for taking them off and refixing them on completion. When measuring glazing, allowance must be made for the rebates in the enclosing members of the door.

In this demonstration, the glazing is measured provisionally. In situations where shop drawings of glazed joinery items are not available at tender stage, the QS may choose to include scaled measurements when billing these work items. These measurements are subsequently firmed up on site and adjusted, if necessary, at final account stage. This approach may also be viewed as a pragmatic alternative to the somewhat ‘forensic’ academic method shown at the end of this demonstration.

Note the annotations used to identify the location of the various panes.
Obscure glass has been taken to the front door and bathroom window.
Again, these measurements are **provisional**.
### PAINTING AND DECORATING

This worked example involves varnishing new second fixings and joinery. Iroko is a hardwood and does not require the preservative treatment required for softwood joinery items.

#### Second Fixings.

Painting second fixings is generally measured in square metres unless it is less than 300mm in girth and isolated from similar work, in which case it is measured in **linear metres**. The dimensions here have been copied down from the window board total on page 1 of the take off.

#### Glazed Doors and Screens

Painting glazed doors and screens is measured in **square metres**. The painting general rule Q134.1.4 states that 'work shall be measured on the exposed face except for glazed surfaces which shall be measured as plane surface across frames and glass. Opening edges are deemed to be included within this measurement.

All panes in these doors exceed the 0.15 sq.m. classification.
Windows
Painting windows is measured in **square metres**. As with the previous glazed doors, the painting general rule Q134.1.4 states that ‘work shall be measured on the exposed face except for glazed surfaces which shall be measured as plane surface across frames and glass. Opening edges are deemed to be included within this measurement.

Where panes of more than one size occur they shall be averaged thus avoiding the need to categorise the work as not exceeding 0.15 sq.m.

External painting
These measurements follow on from the internal painting totals.
An ‘Academic’ Approach to Measuring the Glazing

This method adopts a more scientific (intricate) approach to measuring the glass based on the details shown on Drawing 31-2 and provides a check on the accuracy of the scaled dimensions.