The right moves – Part I

In this first part of a 2-part series of articles on movement management, **Jerry Tyrrell** examines how best to avoid unsightly cracks.

CPD Academy is a new series of 'lessons in print' for Building Connection *readers to help you improve your trade skills and business know-how so that you can keep your edge in today's competitive marketplace. Well-known Sydney consultant, Jerry Tyrrell, a co-founder of Tyrrells Property Inspections, shares his insights into the basic principles of building practice – what to do, what not to do and where to go to find out more.*

You all know waterproofing mistakes are the most expensive things to rectify when building. But cracks often worry your clients more and make you and our industry look bad. In fact, cracks = movement. And movement-related problems are causing far too many call-backs and costly repairs.

Most repaints I organise cost at least 30% more than necessary because I have to get joints cut and render redone around areas of predictable movement. Or, I'm in court trying to get good builders out of trouble when they haven't allowed for the correct movement in tiles, stone, timber or even plasterboard.

This article will help you understand what causes movement and how best to prevent it. It will pay to read the whole article. However, like most things the solution is easy if we get the basics right.

To manage movement you simply need to know a couple of basic rules:

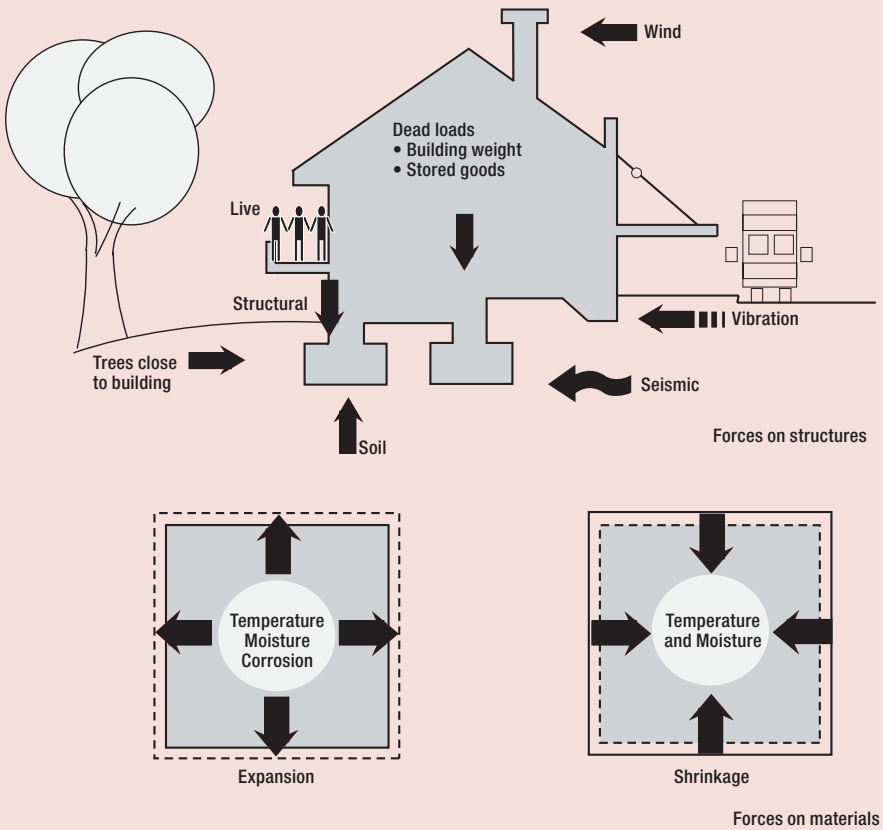
Movement principles

Temperature principle – all materials change size as the temperature changes – they swell with increases and shrink with decreases.

Moisture principle – changes in moisture content or humidity affect timber and masonry (and soils).

TABLE 1 - FOUR MAIN CAUSES OF MOVEMENT

CAUSE		EXAMPLES
Structures		
Loads	• Static	Dead load, i.e. weight of the building.
	• Dynamic	Soil movement, including earthquake, live loads (i.e. people and stored goods); unexpected (i.e. vibration, collision and explosions).
Material		
Temperature		Expansion as temperature rises and shrinkage as temperature drops.
Moisture		Shrinkage as material dries and expansion as material takes up introduced or local moisture.
Chemical		Corrosion, i.e. rust



Forces on structures and materials

Big principle – large areas or long lengths of any materials will generate considerable stresses and forces.

Movement management

Separation rule – keep **different** materials apart with joints in the right places.

Absorb rule – make sure any movement will be handled within the component or unit and not affect other materials or finishes.

What causes movement?

If you need to know the technical stuff, movement happens because of forces within or against materials or structures. Most movement is dynamic and is called reversible, such as thermal changes in metals or wind load against fibre cement façade panels. Some of it is permanent and is called irreversible, for example concrete shrinkage and brick growth.

There are 4 main causes of these forces, see Table 1 on page 28.

Prevention

One hundred years ago, movement wasn't much of a problem because our buildings were simpler and mainly brick or weatherboard. The main issue was cracking due to subsidence or ground movement because we didn't dig our footings deep enough. Today, this has been solved with properly engineered footings and slabs.

Modern buildings are using lots of different materials to get the shapes and look our clients want.

We know oil and water will **not** mix. We know some personalities will never get on. We know different materials move differently. So why do we keep thinking we can mix them together?

Certain 'high risk' factors must always be considered:

- buildings not built to rock will have more movement in the structure;
- seismic activity; and
- large areas or long lengths will **always** need joints.

If we are going to mix so many materials, we need to locate effective joints wherever they are necessary.

Locating joints – two nails and a string line?

Making sure the joints go in the right place is **essential.** If not, you'll go to a lot a trouble and still get cracking around the joint you thought was going to be OK.

Here is my way of making sure **everyone** gets it right:

- Step 1 – Finish tops of masonry and concrete edges level, plumb and parallel
- Step 2 – Place a concrete nail at ends/corners of **every** joint
- Step 3 – Render surfaces
- Step 4 – Snap lines between all nails
- Step 5 – Tool/make the joint full depth of render – 6mm-wide joints minimum – see Joint Detail on page 30
- Step 6 – Remove nails
- Step 7 – Clean and fill joints with sealant compatible with your paint system
- Step 8 – Paint.

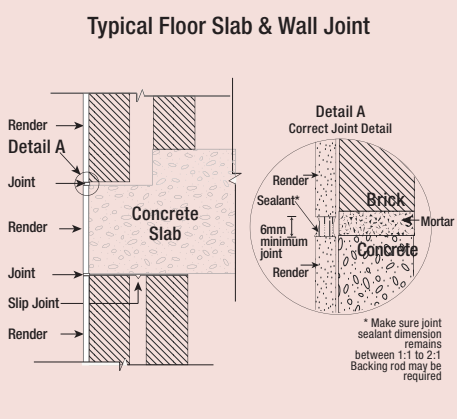
With concrete pavement, just think every 2.4m for large areas and every 1.8m for narrow paths. And add joints at every return and around any corners, planters or platforms.

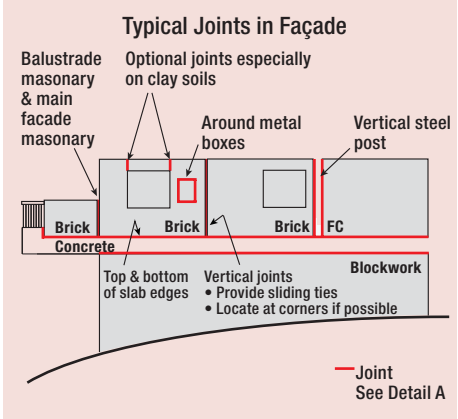
How materials usually behave

Most materials have a movement 'signature'. This is usually a combination of irreversible movement as it dries out, plus daily reversible temperature/moisture/chemical changes in size.

Top ten movement management tips

1. Plan movement when each job starts and mark joints clearly at each stage of the ➤





Left: Floor slab and wall joint systems are fundamental to crack-free buildings.
Right: These are some typical joint systems in domestic buildings.

Table 2 - Material behaviour and construction tips

Material	How it moves		Tips
	Irreversible moisture changes	Reversible temperature and moisture changes	
Concrete	Shrinks as it dries out	Temperature changes	Create joints to all adjacent materials. Cut joints in all external pavement. Charge for 2.4m centres.
Bricks	Expansion after leaving the kiln	Temperature changes	Joint every 9m or 6m for fences. Make sure joints go to full depth and height of wall. Masonry is brittle and articulation is essential over clay soils.
Metal **• Steel** **• Aluminium**		Rapid changes due to temperature	Plan expansion joints in box gutters. Stiffen if used for panels on façades.
Timber		Moisture changes – shrinkage is the main problem	Plan attachment of new floors to old ones carefully. Use a moisture meter to verify actual moisture content of old floor joists. Acclimatise new floorboards. Leave perimeter gaps around all new floors.
Timber fibreboards		Temperature changes	Leave perimeter gaps around all floors.
Glass		Temperature changes	Be careful with any glass embedded into grouts/concrete or subject to rapid temperature changes, eg: pool balustrades, roof glazing.
Plastics	Some shrinkage due to solvent loss in foams/ thermoplastics	Temperature changes	
Tiles	Expansion after leaving the kiln	Temperature changes	Perimeter sealants and plenty of expansion joints are essential.
Plasterboard		Temperature changes	Joint every 4.5m.

job so everyone knows where they are.
2. Separate concrete and masonry surfaces – keep concrete edges level, straight and plumb!
3. Separate plasterboard and rendered surfaces.
4. Construct expansion and articulation joints in all masonry.
5. Don't forget expansion in large plasterboard ceilings and long walls.
6. Joints must be full depth of the material, including the base screeds/beds/grouts.
7. Place perimeter and expansion joints around and in all tiling.
8. Do not use large tiles across joints in sheets or concrete.
9. Select sealants very carefully – choose ones with required elasticity and compatibility with adhesives/paint and which are durable.
10. Avoid 90° bends in waterproof membranes.
11. Work the complex details out with the architect and subbie together on site.

Sources of the best advice?

Think about the materials you are working with all the time. Chat to your engineer mates – the ones you see on site who really know about our industry.

The best book I have read on movement is *Cracking in Buildings*, Bonshor and Bonshor, Construction Research Communications Ltd, 1996.

See you later – but NOT in the CTTT, OFT, tribunals or courts! ■

Jerry has over 30 years' experience as a labourer, tradesman, contractor, architect, mediator, building consultant and author, and has been involved with the inspection and building of more than 60,000 properties (including 30,000 timber pest inspections and 3,000 disputes).

Email your thoughts or experiences to Jerry Tyrrell at jwtyrrell@tyrrells.com

Next Issue: Movement Management Part 2 – fixing cracks.