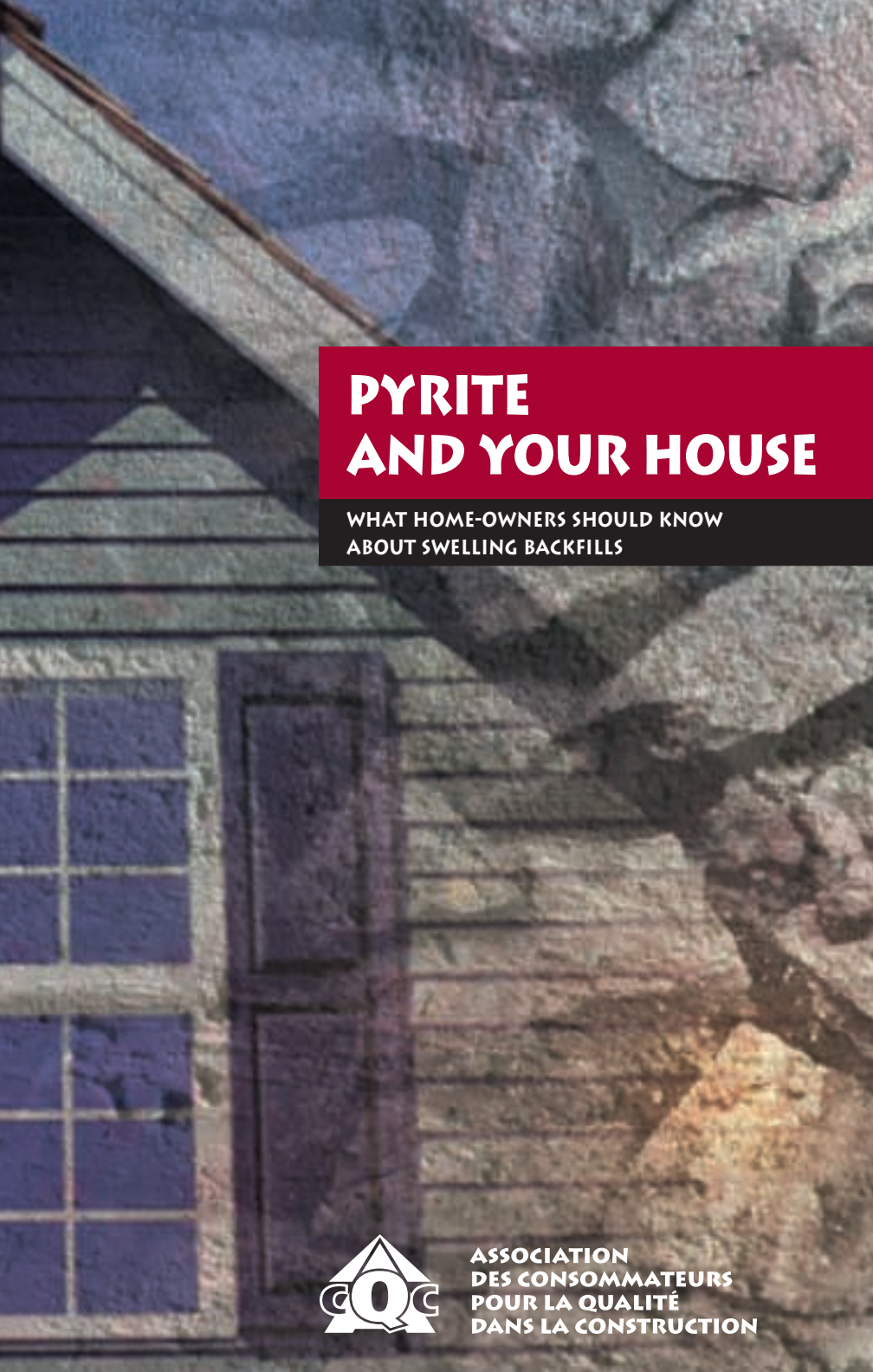

PYRITE AND YOUR HOUSE

WHAT HOME-OWNERS SHOULD KNOW ABOUT SWELLING BACKFILLS

ASSOCIATION
DES CONSOMMATEURS
POUR LA QUALITÉ
DANS LA CONSTRUCTION

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Association des consommateurs pour la qualité dans la construction (ACQC)

What is ACQC?

ACQC is a non-profit organization founded in 1994 by consumers having experienced various serious problems with contractors. It is the only Quebec consumer association specializing in construction.

ACQC's mission is to inform, defend, and protect consumers and, more globally, to improve the quality of residential construction. Hundreds of people from all over Quebec are members of ACQC.

ACQC provides a number of services: information and referral; assistance in lodging complaints; recommendation of contractors and building professionals. It also lobbies authorities and launches class action suits to defend the collective interests of consumers.

The Association also concerns itself with certain specific issues such as warranties for new houses or renovations; problems with settlement; questions related to air quality in dwellings, energy efficiency, etc.

On the issue of pyrite, ACQC has helped the *Regroupement des comités de victimes de la pyrite* (RCVP) organize home-owners. Since the fall of 1998, the Association has been compiling data provided by almost one thousand home-owners, in order to get a better idea of the scope of the phenomenon. It is thus prepared to inform the public about the appraisals, repairs, and legal aspects involved. The Association also sits on the *Comité technique québécois d'étude des problèmes de gonflement associés à la pyrite.*

You can support the *Association des consommateurs pour la qualité dans la construction (ACQC)* by becoming a member. You will find a membership form at the back of this document.

FOREWORD

This guide treats problems associated with sub-slab swelling of backfill containing pyrite. The phenomenon is quite complex. The information contained in this guide was written in collaboration with several experts and reflects as faithfully as possible the current state of scientific and technical knowledge on the subject.

This guide provides general information solely to help home-owners better understand the phenomenon and its impact on buildings. Since each building and each case of swelling will have its particular features, **the reader must not interpret information contained in this guide as a professional opinion on his or her own case**.

Association des consommateurs pour la qualité dans la construction (ACQC), the *Société d'habitation du Québec* (SHQ), the Canada Mortgage and Housing Corporation (CMHC), and all those who contributed to the publication of this guide decline any responsibility for any use made of the information it contains.

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and the

Canada Mortgage and Housing Corporation.

Introduction

With greater public awareness of the problems of swelling attributable to pyritic backfill, the phenomenon has raised anxiety bordering on panic among owners of buildings in the most affected sectors. And the same applies to the real estate market.

The pyrite problem raises a lot of questions— scientific, technical, and legal. Since the fall of 1998, ACQC has received thousands of calls from citizens concerned by some aspect of the problem.

This guide offers the reader answers to the many questions home-owners have asked. The reader should however note that the swelling of pyritic backfill is relatively complex and that several of its aspects raise questions which, for the moment, have not been answered.

In its attempt to take stock of the subject, the present guide can help the concerned home-owner as well as the general public gain a balanced view of the problem, neither exaggerating nor minimizing its seriousness.

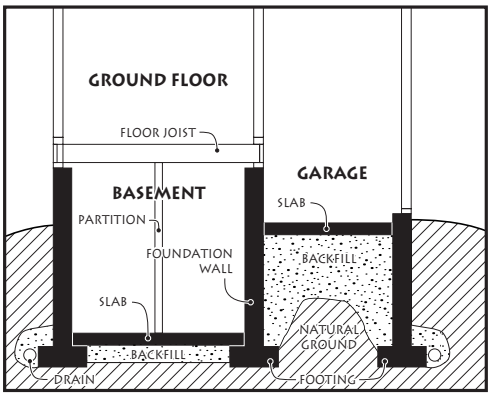
Some basic notions about foundations and backfill

1.1 Foundations

A brief look at the components of the foundations of a typical residential building will make it easier to understand what happens with the swelling of backfill. But please note that, though the description given corresponds to today's most frequently used construction techniques, your house may have been built quite differently.

The foundations rest on the footing which is usually poured directly on the ground surface. In most residential constructions no stone backfill should be found under the footing.

The walls of the foundation rest on the footing.



The slab-on-grade forms the floor of your basement. It rests on the backfill and the interior ledge of the footing, but remains independent from both footings and foundation walls. The slab should not serve as a structural support to either a column or a load-bearing wall. If the basement requires structural support, the slab should have its own footing or a section with greater thickness.

The backfill under the basement slab is usually composed of a 10-to-20 cm layer of crushed stones of uniform size (14 to 20 cm net). The backfill serves as a drainage bed and protects against the ground-level humidity which tends to seep into the house.

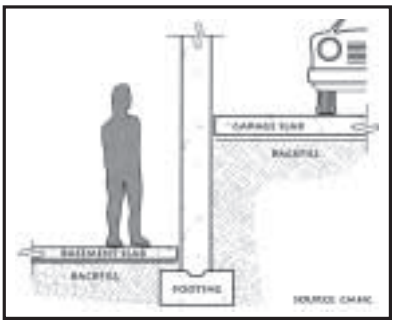
If your building has a street-level garage, the garage slab is not placed on the same level as the basement slab. The backfill under the garage slab may be more than one metre in depth and should be composed either of sand or a mixture of crushed stones of different sizes (1 to 20 mm). The finer particles serve as filler between the larger stones, thus forming a stable surface for the slab. This backfill is usually compacted.

In some types of buildings, the garage is on the same level as the basement. In this case, the same type and thickness of backfill will usually be found under both slabs. There should also be a deeper excavation near the garage door, to guard against heaving caused by freezing.

1.2 *Aggregates used as backfill*

Prior to adoption of the voluntary control procedure (CTQ M-100) on 15 April 1999 (examined in greater detail in section 3.3 of this guide), backfills for residential constructions did not have to comply with any particular standards.

Three main categories of crushed stone were to be found on the market for use as backfill:

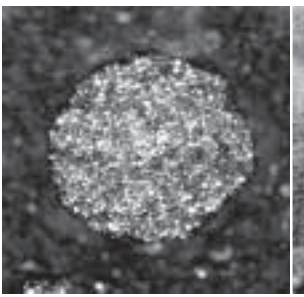


- The low-cost all purpose category, locally called "*tout venant*" or TV is composed of easily crushed stones. It is used in commercial and residential construction. It comes in all sizes (grading): 5, 10, 14 or 20 mm or a mixture of 0 to 20 mm. Clay-rich shale, one of the types of stones likely to cause swelling, is to found in this category.
- The second category of crushed stone is made up of harder stone such as limestone. This category is called MUN, because it is required for all municipal projects, with their stricter regulations.
- The third category is called MTQ (for *Ministère des Transports du Québec).* This category requires a mixture of high quality stone with a controlled grading of 0 to 20 mm.

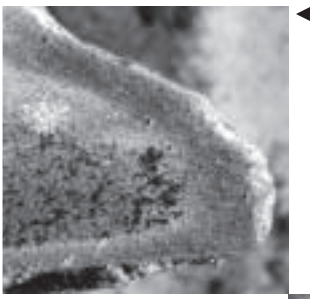
Swelling linked to pyrite

2.1 Oxidation of pyrite

Pyrite (FeS_2) is a very common mineral. Traces of it are found in the sedimentary rock used to make crushed stone for backfill, in regions where problems of swelling have been encountered.

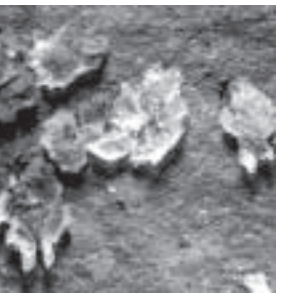


▲ *Raspberry-shaped pyrite seen under a microscope.*



◀ *In this cross-section, we note that the coloration at the centre of the stone differs from that around its rim. Oxidation progresses from the exterior towards the interior.*

Gypsum crystals seen under a microscope. ▼



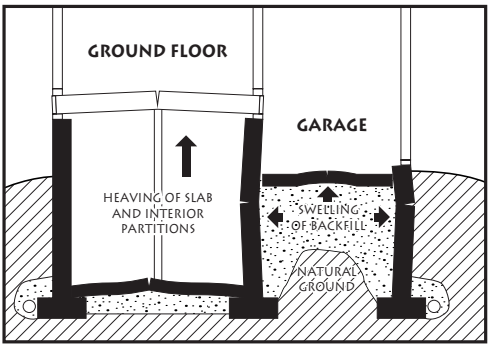
In the presence of humidity and oxygen, pyrite oxidizes and produces sulfuric acid. The acid reacts with the calcium carbonates (for example, limestone) found in the crushed stone.

This chemical reaction produces sulfate and can form gypsum whose crystallization will cause the stone to burst, the backfill to swell, and the concrete itself to crumble and swell.

This is usually a slow process. On average, it will take about ten years before any perceptible damage is produced.

2.2 Swelling of the backfill

The chemical reaction may cause any pyritic backfill under the concrete slab to swell. The swollen backfill may heave the slab and interior partitions resting on it. This may also damage upper floors and interior partitions.



The levels of sulfuric acid and sulfate and the amount of swelling produced will depend on the thickness and pyritic content of the backfill. This is why more swelling occurs in residential garages where the layer of backfill is thicker than under basement slabs.

Furthermore, since the crushed stone used under garages is usually composed of compacted aggregates of different sizes, with little room for give between the stones, this accentuates the problem.

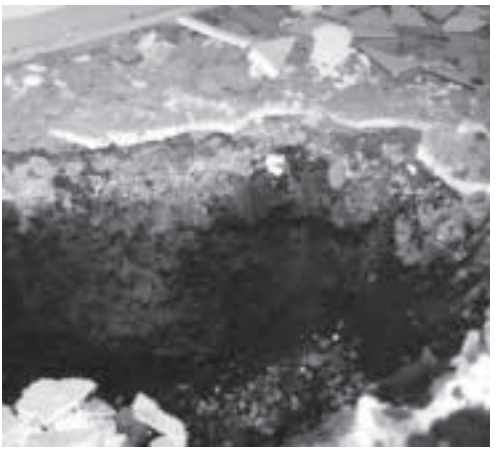
2.3 *Sulphation causing concrete to swell and crumble*

Sulphation also causes the concrete itself to swell and crumble. It can produce the most spectacular incidents of swelling (up to 15 cm).

The humidity under the slab tends to creep upward, transporting the sulfuric acid produced by oxidation. Thus, when the sulfuric acid comes into contact with the bottom of the slab, the concrete swells from sulphation and starts flaking and disintegrating from the bottom.

The swelling concrete expands the slab vertically and horizontally. As horizontal expansion is restrained by the foundation walls, heaving usually occurs more towards the centre of the structure, sometimes creating large bulges which leave an empty space under the slab and produce raised star- or cross-shaped cracks.

Though problems linked to the sulphation of concrete usually occur along with the swelling of backfill, damages may occasionally stem only from sulphation of the concrete with no swelling of the backfill. This is often seen to happen in older buildings.



Excavation of pyritic backfill. Note that the slab attacked by sulphation is now scarcely more than a few centimetres thick.

Protecting concrete from sulphation

The *National Building Code* recommends placing a polyethylene vapour barrier between the backfill and the slab. The vapour barrier will thus protect the concrete from sulphatic attacks.

Unfortunately, builders have been slow to follow this recommendation over the past twenty years.

2.4 Damage to foundation walls

In some cases, the lateral thrust of the backfill will produce cracks in the foundation walls around the garage.

This does not usually occur in basement walls, since the pyritic backfill is found only at the footing level.

Sulfuric acid may sometimes attack the footing and foundation walls of garages, but this seems to be a rare occurrence, as few cases have been reported. As previously mentioned, the humidity transporting sulfuric acid tends to creep upward toward the slab.

2.5 Swelling of sub-soil

In certain zones where rocks with swelling potential surface, they may damage buildings when they do swell. This was the case for certain large buildings in the regions of Quebec City and Ottawa and on Montreal's South Shore.

The swelling may cause the building's foundations to heave and thus cause serious structural damage.

In Greater Montreal this type of swelling is rare and seems to have affected only a minority of residential buildings.

Brief historical background

3.1 Awareness of the problem

In scientific circles, awareness of the problems caused by the swelling of rocks containing pyrite dates quite far back. The first cases were reported around 1930 in the United States. In Canada, a very explicit text on pyritic clays in the Ottawa region was published in 1975 by the National Research Council in the *Construction Digest.* In the Montreal region, cases of swelling were reported as early as 1985. At that time, it was thought that these were isolated cases.

In 1997, the Montreal section of the Association of Engineering Geologist (AEG) held a scientific conference on the subject. A few months later, in the fall of 1998, television reports finally exposed the scope of the problem. Since that time, more than a thousand persons have notified the *Association des consommateurs pour la qualité dans la construction* (ACQC) that their house seemed to show symptoms of pyritic swelling.

3.2 Distribution of cases

Pyritic backfill may come from quarries with rock containing pyrite, from excavations of large public works (aqueducts, highways, subways, etc.) or, more rarely, from mining or blast furnace residues.

In the Montreal region, swelling backfill may contain limestone, but will be most likely composed of clay-rich shale and pelites from the Lower St. Lawrence.

Though the majority of properties affected are located in the Montérégie, cases are also reported in other sites on the island of Montreal and surroundings and on Île Jésus.

Most cases occur in buildings from 8 to 20 years old. However, a few older buildings (30 and even 40 years old) are also affected. Damage is also reported for buildings put up less than five years ago.

It is worth noting that, under the basement slabs of residential buildings constructed before 1970, the layer of crushed stone will be either non-existent or quite thin. This explains why there are very few problems for buildings constructed before 1970. The early 80s saw an upsurge in the construction of new residential units which peaked at nearly 75, 000 in 1987. We thus find a proportionally higher number of "pyritic houses" dating from that period.

3.3 New methods of evaluation

The *Comité technique québécois d'étude des problèmes associés à la pyrite* was set up following the 1997 AEG conference by professionals looking for answers to the many questions raised by the growing number of cases of swelling backfill.

CTQ M-100

The *Comité* developed a means of standardizing laboratory techniques for evaluating swelling potential. The construction industry adopted the CTQ M-100 method voluntarily to ensure that the stone sold by quarries as backfill would henceforth be certified as non-swelling.

Since April 1999, most aggregate producers have been applying this method. The certification is designated "DB" which stands for *dalle de béton* (concrete slab). It is, however, to be understood that the we are not talking about a compulsory standard and consumers should remain vigilant. They should demand "DB" certified stone for work under concrete slabs and check to make sure that the delivery slip bears the "DB" certification. The delivery slip must contain: the abbreviations of the laboratory having issued the certificate; the dates starting and ending the attestation's validity; the address of the backfill's destination; the delivery date; the letters DB; and a declaration signed by the truck driver.

For a new house or for renovations, consumers should always demand that the contractor give them the original delivery slip certifying that the backfill is "DB" quality.

CTQ M-200

The *Comité* next worked out a method for supervising assessments of existing buildings. Home-owners wondering if their building has a problem with swelling or might develop such a problem in the future can now hire an evaluation specialist and require the use of the CTQ M-200 protocol. They will thus rest assured that the inspection of their building and the analysis of the backfill samples will produce the clearest and most accurate conclusions possible.

Even with this method, there will always be cases where diagnosis is inconclusive, because, for existing buildings, there is no precise threshold separating an acceptable from a problem material.

Besides evaluating the potential for swelling, the consultant must take into account several other conditions of the building itself and its surroundings.

In some cases, consultants will only rate the problem on a scale of 0 potential to a very high potential, with a grey zone in the middle.

From a scientific point of view, the swelling of pyritic backfill still raises many questions. The coming months and years will probably bring additional answers and other details.

Although it is theoretically conceivable that oxidation might be neutralized without removing all the backfill, no other reliable preventive measure has yet been found and it might take years to develop and test such a procedure.

3.4 Pyrite and health

Can the swelling of backfill have harmful effects on the health of the occupants of the house? In the opinion of the Montérégie Public Health Department, the quantities of sulfuric acid are too minute to cause health problems.

The pyrite might eventually be the indirect cause of health problems: cracks in the slab and in foundation walls could increase humidity in the basement. So, close watch should be kept for traces of mould to prevent air quality problems.

And, as with all kinds of construction work, the work site should be confined to avoid respiratory problems caused by dust.

The swelling of pyritic backfills thus does not seem to pose any greater health problems than other types of damage to foundations, and it requires the usual precautions.

Liability

The scope of the problems linked to pyrite is probably the combined result of ignorance and carelessness.

Although ignorance often serves as an excuse, it is never, in legal terms, an argument which frees one from all liability. But, considering the problem in its entirety, it appears difficult, as things stand today, to point out one or more "big culprits."

4.1 Legal action for latent defects or construction defects

This section contains a few general pieces of information on law suits, which must not be construed as legal advice. If you are planning to take legal action or if you are being threatened with a law suit, consult a lawyer specializing in the field of real estate.

If there was no visible sign of a pyrite problem at the time of purchase, the buyer could sue the seller for latent defect. If the building bought is a new construction, legal action for construction defect can be taken against the builder, if the latter is still in business and solvent.

Lawyer's fees can climb to thousands of dollars and they are not reimbursable by the defendant. The value of the damage and the solvency of the defendant must thus be determining factors in any decision to start legal proceedings.

For example, if the damage is evaluated at about $5,000, the buyer could lower the claim to $3,000 and plead his case in small claims court, even it this entails spending a few hundred dollars to consult a lawyer on how to prepare and present the case.

Who should be sued?

The owner of a house damaged by swelling backfill can take legal action against the physical or moral person with whom the sales contract was signed, meaning the person having sold the property.

When damage to a new house appears less than five years after construction, the owner has the right to take legal action not only against the builder but also against the guarantor (APCHQ or ACQ).

Moving down the contractual chain, the seller being sued can turn around and call on the warranty of the previous seller and this process can keep on going back to the builder who can, in turn, sue the supplier of backfill.

Is there any statute of limitation?

As regards legal action for latent defect, Quebec's *Civil Code* places no limit on the period separating the time of sale and appearance of damage. So long as the defect was present at the time of sale, legal action can be taken several years after having bought the property.

The *Civil Code* does however oblige the buyer to notify the seller of the defect reasonably soon after the problem is discovered or as soon as [the present owner] becomes aware of its seriousness and scope. The buyer must send the seller a registered letter reporting the problem. The courts have ruled that, depending on the circumstances, this period should at most be between three to six months.

If an owner notices several cracks which should normally lead him to suspect a problem with pyrite and, despite this, lets things slip for several months before reacting, this owner could lose any right to legal action.

The same holds for warranties. The seller receiving a letter of notification or a summons from the buyer must immediately send a similar notice to the previous seller.

The buyer has three years to take the case to court. This period starts as soon as the buyer notices the seriousness of the problem, thus, at the same time as the period for giving notification of the problem.

Minimizing damage and giving the seller time to act

The buyer cannot act unilaterally. He cannot, for example, undertake any work without having given the seller the opportunity to come and examine the damage, nor can he engage his own expert consultants or do the work himself.

The buyer must also do what he can to minimize the damage. As soon as a problem is noticed, he should refrain from doing anything that could increase the cost of his claim: for example, renovating the basement, while claiming that the backfill under it is swelling.

Can one plead ignorance?

Contrary to popular opinion, one cannot argue ignorance of the presence of a defect as a protection against legal action.

If it is proved that the seller knew about the defect and deliberately withheld or camouflaged this information, the buyer could, in addition to suing for latent defect, also ask for payment of damages and interest or for cancellation of the sale with damages.

So, if as owner of a building you plan to sell your property, it is in your interest to have a thorough knowledge of all its potential problems and to divulge them to any possible buyer.

This advice is valid not only for problems with swelling backfill but for any problem likely to lower the value of the building. It is much better to assume a limited loss during the transaction than to be overtaken five, ten or twenty years later by legal action for latent defect.

Seeking out-of-court settlement

At some point in the proceedings, one of the parties might propose to the other (or others) that the case be brought to mediation or arbitration. There are certified arbitrators or mediators who, for a fee, will provide professional services making it possible to handle the dispute outside the legal framework. With the help of a mediator, it is possible to find grounds for agreement between the parties and avoid confrontation. All the parties must sign a contract agreeing to the procedure and must share the cost of arbitration or mediation, according to whatever terms are chosen.

The parties involved can also come to an out-of-court settlement without the help of a mediator or arbitrator. This settlement might, for example, stipulate that each will share the repair costs equally. Before signing such a settlement, we strongly recommend that its terms be examined by a lawyer or a notary.

4.2 Real estate transactions

If, when making a real estate transaction, the buyer has a sample of the backfill analyzed in a certified test laboratory, this should give him an accurate picture.

This test also allows the seller to reduce the risks of any future legal action for latent defect.

For this kind of mandate, you are advised to ask the professional hired to follow the *Méthodologie d'expertise sur les bâtiments existants* (CTQ M-200).

Conditional purchase offer

In sectors most affected by problems of swelling, it has become common for buyers to make an offer of purchase conditional on analysis of the backfill under the slab. In other words, the buyer is asking the seller to guarantee that there will not be any problem with the quality of the backfill.

The condition should be stipulated as clearly as possible, so as to avoid any complications or law suits.

The prospective buyer should demand that the analysis be carried out according to the *CTQ M-200* methodology and that the laboratory is a member of the *Association canadienne des laboratoires d'essais* (ACLE).

The condition should also mention that the seller must give the prospective buyer a copy of all the documents contained in the evaluation.

The condition should finally specify that the evaluation must "be to the buyer's satisfaction," without further stating exactly what conditions would make the results acceptable. This last point is very important, since the conclusions of experts are very often based on

several interrelated and complex factors. In most cases, the conclusions cannot be simply classified as "yes", "no" or "perhaps"; each case is different and the final decision must fall to the buyer.

As a rule, ACQC advises the buyer that the period set for carrying out the conditions of the purchase offer should be rather long than too short. It is in the interest of the parties in the transaction to leave enough time for unhurried reflection.

Experts also need time to make a proper diagnosis. Find out from the test laboratory how much time is needed and add a few days as a comfort zone.

Is this test compulsory?

Nothing forces the seller to have the test done. In certain localities, however, buildings may be impossible to sell without the test.

It is usually the seller who bears the expert's consulting fees.

Who is responsible for the quality of the test?

The evaluation done according to the CTQ M-200 methodology will allow the buyer to obtain a professional opinion on the backfill's swelling potential. This opinion should be backed up by professional liability insurance. In other words, if the diagnosis is wrong, the owner having ordered the evaluation should be able to take legal action against the professional concerned.

For a residential building, it is presumed that a single sample of the backfill taken at any spot of the basement or garage should be representative of all the backfill under the basement or garage. This is generally the case.

In certain rare cases, two different samples have given different results for the same basement or garage.

This is why the expert's report will often carefully hedge the extent of responsibility, in terms of the specific case and the particular constraints of this type of evaluation.

Unless their results are categorically positive or negative, "pyrite tests" (costly as they may be) must not be seen as guarantees.

The twilight zone…

The most touchy cases surface when it comes to interpreting the results, especially if the backfill shows a weak potential for swelling and the building has little or no damage or if the expert's conclusions are vague.

Generally, the prospective buyer who has questions about evaluation results should first contact the laboratory and ask for explanations or further details.

If the buyer is not completely satisfied with the results, he will usually have four options with regard to the purchase offer (subject to the specific conditions that have been written into the offer). He may:

- Withdraw the purchase offer
- Ask for a lower price
- Ask the seller to have any work required done
- Ask for a new evaluation

What then…?

In theory, when a transaction is finalized after a conditional purchase offer hinging on analysis of the backfill, the buyer is presumed to know about the problem; he thus cannot take legal action for latent defect if a pyrite problem develops in the future.

However, if the analysis produces reassuring results which are disproved in reality and swelling of the backfill is noted after the transaction, the buyer will have the right to sue the seller provided that the consultant was hired by the latter. In other words, the weight of guarantee that the building is free of defect must be borne by the seller even when an evaluation has taken place; the consultant must, for this reason, be hired by the seller. Otherwise, the buyer's only recourse would be to take legal action against his own consultant for professional error.

If an analysis concludes that there is a weak or negligible potential for damage, the prospective buyer wishing to guard some legal recourse could impose additional demands on the seller. The buyer could require that the seller specifically guarantee the quality of the sub-slab backfill by affixing to the sales contract a conventional guarantee to that effect or by obtaining a declaration from the seller based on the evaluation report.

In this way, if the evaluation proved to be false, the new owner could still sue the seller and the latter could take legal action against the professional hired.

A lawyer or a notary is authorized to advise the buyer on how such clauses should be inserted into the sales contract before the transaction is finalized.

Conversely, the seller who wants to make sure the "pyrite" problem is a closed book could ask his legal adviser to specifically exclude any warranty on the quality of the backfill.

Such an exclusion clause in a legal warranty may, however, be judged abusive in court, depending on the way it is introduced into the transaction—for example, if the seller is suspected of having used it to mislead the buyer. The courts will not tolerate any contradiction in matters of exclusion and demand great transparency on the part of the seller. If there is any contradiction between the purchase offer and the sales contract, the version offering the guarantee will be honoured over the one withdrawing it.

As a final point on the legal guarantee, we note that contractors or real estate promoters cannot limit their responsibility by using an exclusion clause such as the one described above.

It is to be hoped that in upcoming years, as knowledge about pyrite grows and becomes more widespread, the public will have a more realistic perception of the problem and its negative impacts on the real estate market will decrease accordingly.

Rental property

If you have to move out of your house and you expect its sale to produce serious financial losses because of swelling backfill , you could consider renting it temporarily.

Renting could be an interesting fiscal option. As an owner of rental property, you could deduct the cost of repairs from your income. Obtain the services of a tax consultant, in order to find out whether this would be an advantageous possibility in your situation.

Real estate brokers and agents

Real estate brokers and agents have been instructed by their associations on how to handle "pyrite cases." They are notably obliged to ensure that the parties involved, both seller and buyer, are properly informed. They must not, however, venture to make statements about questions which are outside their competence—for example, on the condition of the building. To find out about the rules of conduct for real estate agents and brokers or to lodge a complaint, you may contact the *Association des courtiers et agents immobiliers du Québec* (ACAIQ) at (450) 462-9800 or 1-800-440-7170 or on the Internet: www.acaiq.com.

4.3 The special case of condominiums

In the case of condominiums, any problems with the slab, the foundations, and backfill are the joint responsibility of all parties involved, which means the condominium association, unless otherwise stipulated in the condominium declaration.

Therefore, any condominium owner wishing to sell his unit must persuade the association to make the evaluation for potential backfill swelling, if a prospective buyer so requests. This seller could present such a request to the directors of the association or during a meeting of the tenants.

The *Civil Code* specifies that one of the duties of the association is to see to the upkeep of the building. The association may not be obliged to authorize an evaluation in every case, but, assuming that the co-owner is not making an idle request, the association could, by its refusal, be courting serious legal complications.

If the slab and backfill are located in the commons, the costs of any repair work for pyrite will have to be shared by all the co-owners, including, if necessary, the complete restoration of apartments located in the basement and relocation of tenants living in these units.

The *Civil Code* requires that the condominium association set up a contingency fund drawn from tenants' fees for upkeep of the building. This fund is meant, notably, to bear the costs of any major repair work; the association might thus decide to use this fund for work required by a problem with pyrite.

One of the first questions arising when there is a problem with condominium real estate is thus the following: What funds are available to fix this problem? This information can be a determining factor in the resale of a "condo."

The prevailing climate of legal opinion regarding condominiums suggests that it is in the buyer's legal interest to file suit against the individual seller in case of latent defect.

This means that, if there is a problem with swelling backfill, the buyer can sue the seller for latent defect without involving the tenant association. But this would not stop the association from filing its own suit, against the contractor, for example.

Many other legal questions may arise concerning damage to condominiums attributable to pyrite.

Condominium tenants' associations can obtain advice from the *Association des syndicats de copropriétés du Québec* at (514) 866-3557.

4.4 Property valuation

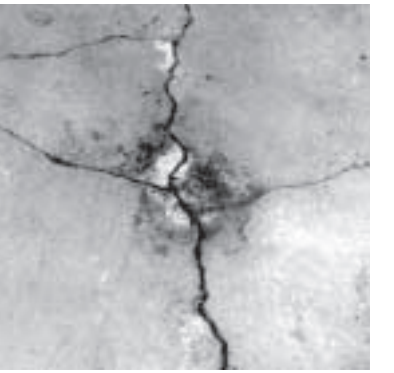
The owner of a house damaged by the swelling of backfill could ask to have his property valuation lowered. For the owner who is not planning immediate repair work, this could mean savings of several hundred dollars in tax yearly. Contact your municipality to find out what procedure to follow in obtaining a re-evaluation.

Should there be a disagreement between the Real Estate Valuation Department and the owner about the amount of reduction, the latter can request a revision by Quebec's *Tribunal administratif.*

As soon as the necessary repair work has been done to correct the problem, the real estate valuation will be raised again to the former level.

Guide for home-owners making their own evaluation

5.1 Characteristic signs

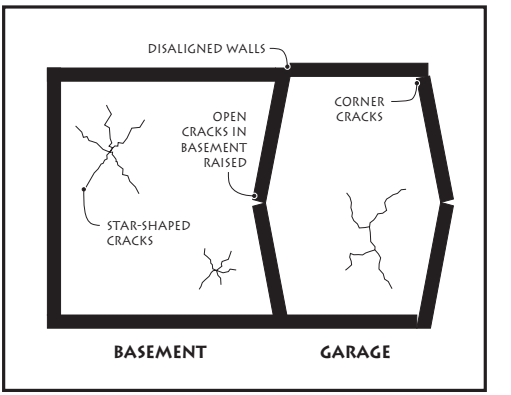


A number of signs indicating pyritic backfill will be apparent simply upon careful inspection.

Note that your building may have problems with swelling from pyritic backfill even though all the signs described below are not present. On the other hand, the presence of any of these signs will not necessarily indicate a problem with swelling backfill.

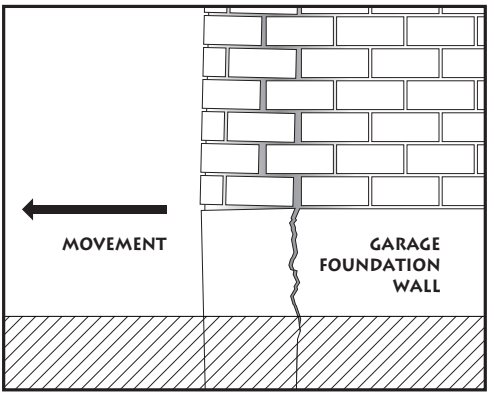
Here then are the typical, easily observable signs:

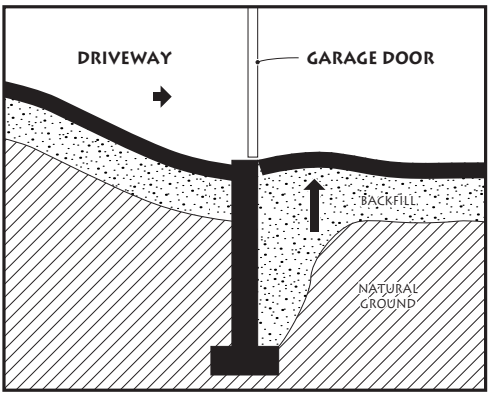
- Gradually spreading, often star- or cross-shaped cracks in the concrete slab
- Heaving of the concrete slab in the form bulges or domes
- Presence of needle-like white crystals mixed with the concrete near the cracks. Observations with a magnifying glass should reveal the characteristic shape of crystals, resembling snow flakes. These crystals are very fragile and disintegrate as soon as touched.



- When partition walls rest against the basement slab, they may show signs of bulging, drywall may crack, doors may stick.
- Similar damage may appear upstairs, if the pressure is transmitted to the floor above by partition walls.

- If the garage is at ground level, the swelling may exert pressure on the foundation walls, often creating open cracks in the exterior walls. These cracks are generally vertical. The same pressure often causes cracks in the corners of foundation walls.
- If there is strong lateral pressure, the exterior wall of the garage may become detached at the corners and lean outwards. The edges of the corner cracks should then be seen to split apart and become disaligned.
- For basements at half-basement level whose floor is located at ground level, the concrete slab may heave more near the garage door where the backfill is thickest.





5.2 Evaluating the scope of the problem and the urgency of repair work

Since concrete slabs are not usually structural elements and since swelling progresses very slowly (an average of 1 to 5 mm per year), it is rarely urgent to respond to the swelling of pyritic backfill.

However, it is preferable to act quickly when the swelling affects the solidity of the garage's foundation walls or when basement partitions start to make the house's upper floors heave.

A few other indicators can give a better idea of the scope of the problem:

- If the concrete starts to crumble, this is a likely sign of advanced sulphation. You can test by striking the slab with a hammer; if the slab sounds hollow in some spots, this indicates that heaving from sulphation has formed a pocket under the slab.
- If the floor buckles up towards the centre of the upper floors of the house, this may be caused by the heaving of the basement slab. It is then crucial to keep close track of the spread of damage and to act before it becomes serious enough to lead to more costly repairs.

Stay on guard:

- If large cracks appear in the foundations and if water seeps in: regular water seepage will accelerate the oxidation of pyrite and may cause other problems such as growth of mould. You should thus seal the cracks, preferably with a flexible sealant.
- In a house less than twenty years old, before finishing the basement with a false floor and new partitions, it might be opportune to do a laboratory test to find out the composition and swelling potential of the backfill.

5.3 Other possible cases of damage to slabs and foundations

Pyritic backfill is the only probable cause for central heaving of a concrete slab. However, some signs of heaving are, in fact, produced by settling of foundations or backfill. Proper identification of the problem is critical in order to avoid useless laboratory tests; but making this identification is not as simple as it may seem. In certain cases, using a surveyor's level to measure the degree of disalignment could provide useful data for making a diagnosis.

5.31 Problem with sinking sub-soil?

Fragile clay soil is common in the Saint Lawrence valley. This clay contains numerous small cells of water. When the cells of the clay are broken by excessive shocks or weight, the water released causes the soil to lose up to 75% of its resistance and this may cause foundations to sink.

Similarly, during a dry spell, loss of the clay's water content may cause foundations to sink or settle. Sinking of the foundations or slab on one side of a building may act as a lever and raise the other end of the slab.

Other types of soil, such as loose sand or organic soils, may also become compacted under foundations or backfill, causing buildings to sink. Similarly, using inappropriate materials or improper techniques for backfilling under foundations during construction may lead to problems with sinking.

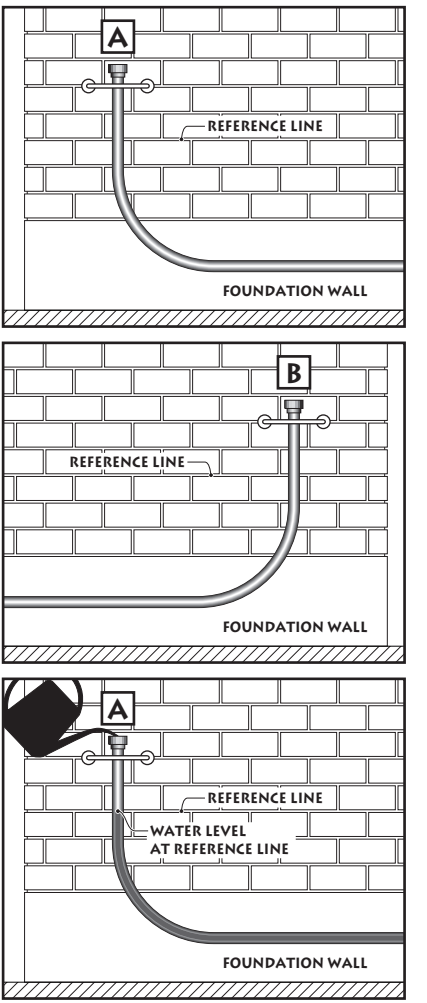
If you suspect a problem with sinking sub-soil, contact your municipality to find out the composition of soils in your sector.

Specialists (surveyors or specialized contractors) can use a surveyor's level to measure the difference between the highest and lowest points of the house. This will give an exact measurement of how much the house has sunk.

In certain cases, you can measure the degree of sinking yourself using a transparent or translucent watering hose. Take a look at the adjacent illustrations:

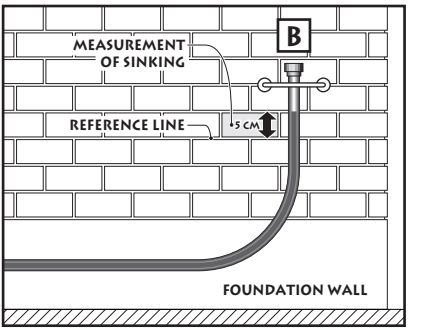
Fix end A of the hose to one extremity of the wall, taking as a reference point a line on the building which should normally be horizontal. This might, for example, be the fourth row of bricks (Brick layers may sometimes "cheat" by laying the first rows so that the bricks are on a level at about the fourth course.)

Repeat the operation with the B end of the hose at the other extremity of the wall.



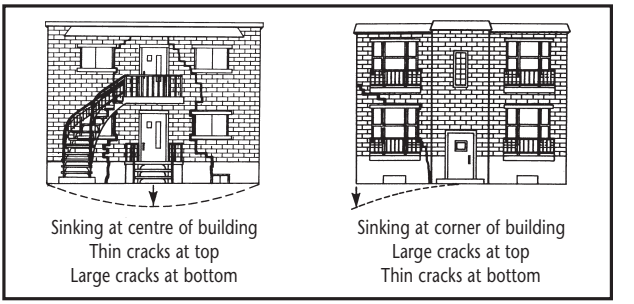
Fill end A of the hose with water up to the reference line. Then, at the other end of the hose measure the difference between the level of the water and the reference line. You will thus have a reliable measurement of the degree the foundations have sunk.

To measure sinking at the other corners, repeat the operation by moving one end of the hose.



5.32 Cracks in the foundations

The presence of pyritic backfill under the slabs does not cause any heaving or sinking of the footings or foundation walls. The horizontal thrust of the backfill generally creates vertical cracks only in the foundation walls surrounding the garage.

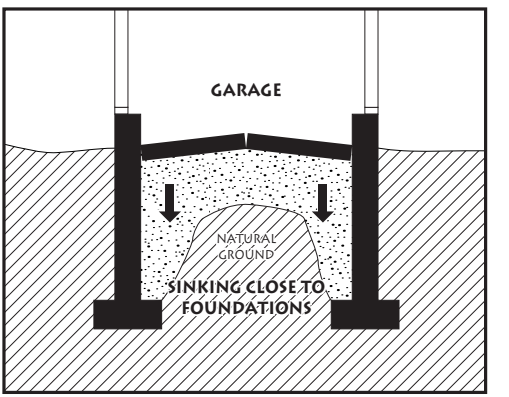


Sinking or heaving of foundations caused by freezing generally creates slanted or stepwise cracks.

The position and form of the cracks in the foundations indicate the type of movement taking place and can show us whether we are dealing with horizontal or vertical movement.

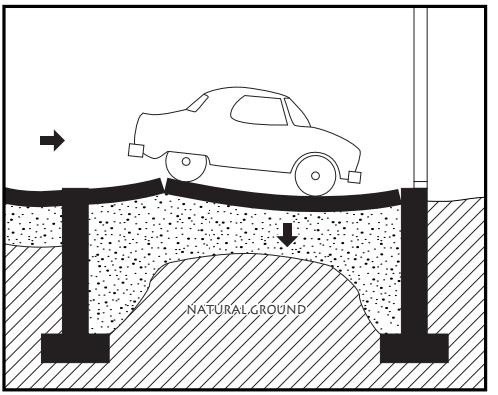
5.33 Sinking of garage slabs

The concrete slabs in garages are sometimes reinforced with steel mesh that will keep the slab intact even if cracks occur. This means that any occasional shifting of the backfill under the slab will generally cause the slab to rise up somewhere else, as when the back of a boat sinks and raises the front. Garage slabs will generally sink close to the foundations or under the front wheels of the car parked there, because of the weight of the motor.



This type of sinking produces minor cracks and is caused by poorly compacted backfill. After ten years,

compacting has usually stabilized and the concrete slab can safely be repaired at that time.



5.34 Cracks caused by shrinking concrete

Concrete shrinks in volume as it dries. During the first three months after construction, thin linear cracks almost always appear in concrete slabs. These cracks are usually more numerous if there was too much water in the concrete when it was poured or if the slab dried too quickly, something which, unfortunately, is often the case in residential construction. Shrinkage cracks do not, however, cause any other damage and stabilize rapidly.

5.35 Efflorescence of concrete

The efflorescence of concrete produces white powdery spots on the surface of the concrete. This is the crystallization of salts excreted from the concrete. They can be found even when there are no cracks in the concrete. This harmless efflorescence can easily be confused with the gypsum crystals produced by sulphation which build up around cracks and which are shaped like a pile of needles.

5.36 Disintegration of concrete in garages

In garages, when there is only surface disintegration of the concrete accompanied by white rings the cause is usually calcium from cars. In this case, the concrete need only be cleaned and resurfaced.

5.37 Heaving of the concrete slab only near garage doors

This type of heaving may be caused by freezing under the slab. Water seepage, shallow foundations, and poor tightness of doors encourage freezing in this spot.

5.4 Combined problems

When several symptoms are present, preliminary checks are particularly advised in order to pinpoint all the problems. As a rule, if you are faced with contradictory data, you may be faced with two different problems, sometimes even three.

If the symptoms would seem to point to problems other than the swelling of backfill, you would do well to consult a professional recommended by ACQC. This professional will carry out a general inspection of the building and may recommend specialized tests if they are needed.

Development of phenomenon over time

6.1 *Tracking progress of the swelling*

Damage attributable to swelling caused by pyrite usually appears 10 years or more after construction. However, some incidents of swelling may occur after only one year if oxidation of the backfill has already started during construction. This may happen if the crushed stone is exposed to long periods of inclement weather before its use.

Pyritic swelling of backfills will stop when all the sulfur has been oxidized. The speed of reaction will depend on several factors; it takes an average of ten to forty years.

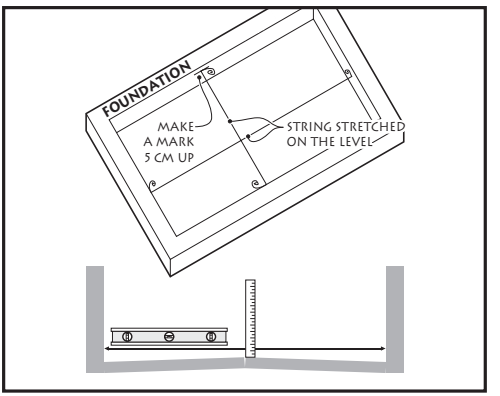
As soon as cracks appear, write down the date and length of the crack in a notebook. If the edges of the crack widen and disalign, measure the gap between the edges. Make a sketch of the floor and any apparent damage.

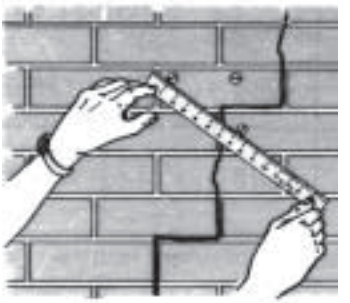
You could also make a file of photos to be used as evidence, if and when you must make your case to an expert, a buyer, etc.

Measure the disaligned gap using a two-metre level. Repeat the measurement from time to time and note the differences.

You could also measure the difference in level by tightly stretching a string from one wall of the foundation to the other, along the length of the room, 5 cm up the wall. Use this string as a reference point to observe the height of the slab at the spot where the crack occurred and its height at the centre of the room. Use a pencil to mark the height and the position of the string next to the foundation walls and note this information in the notebook. Do the same measurements again along the width of the room.

If there is a wood floor where the swelling occurs, whether in the basement or on an upper floor, take the same measurements.



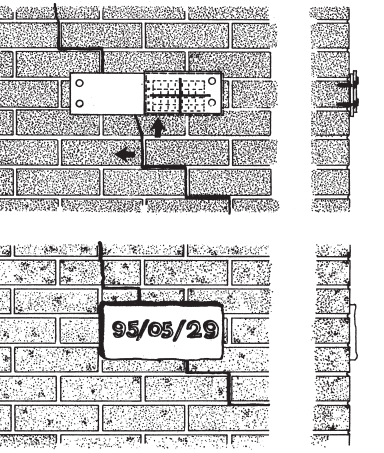


Check for cracks in the foundation walls. Note the length of the cracks and mark the reference points to measure their width. Also measure any disaligned gaps between the edges of the cracks.

About six months later, repeat the same measurements and note the differences. Keep a record of weather conditions which might have an influence on the swelling: draught or torrential rain, hard frosts, thaws, ice, etc.

These data could help you see whether the slab is sinking or heaving and at what rate. If the cracks reappear or increase in number, this means the problem has probably not stabilized.

For the foundations, professionals use a graduated ruler placed across the crack. This device measures very precisely the horizontal and vertical movement of the cracks. It is very useful in determining beyond any doubt whether the movement is horizontal or vertical and in measuring the development of the phenomenon over time. This instrument can be obtained from specialized suppliers. Call ACQC for references.



The crack can also be covered with a plaster of Paris plaque about the size of a chocolate bar. Stuck perpendicular to the crack, the plaque will also crack if the movement continues. Write on the plaque the date it was installed.

The same procedure can be performed using a rectangle of thin glass, stuck over the crack with epoxy.

Please note, however, that these "monitors" may also crack from very slight movements unrelated to the swelling of pyritic backfill. For example, intense cold could cause thermal shrinking of the concrete and cause the "monitors" to break.

All these data, recorded over several years, will probably be the most determining factors in taking the final decision about repair work. They could confirm, in a relatively old and only slightly damaged building, that the movements are very slow or even that the phenomenon has completely stopped. It is thus possible, by keeping track of the evolution of the phenomenon, to avoid undertaking any repair work.

The data collected could also be enough to reassure a potential buyer concerned about the swelling potential of the backfill. If you are planning to sell, be sure to put together a well documented file, with photos as supporting evidence.

WARNING: You should immediately undertake corrective repair work if the swelling is causing serious damage in places other than the slab, notably in the following cases:

- If the thrust of interior partitions in the basement is causing damage to upper floors
- If the cracks in the foundation walls are widening rapidly or if they are wider than a pencil
- If the exterior wall of the garage seems to be spreading or if damage appears in the chimney or the brickwork

In case of doubt, do not hesitate to ask for a visual inspection by a building professional.

6.2 Some tips for slowing the rate of swelling

6.21 Reducing ground level humidity

Absence of excessive humidity can slow down the swelling of pyritic backfill. In practical terms, the process of oxidation cannot be totally stopped but oxidation over a long period of time could cause less damage than rapid oxidation. Ground level humidity can be reduced by better surface drainage:

- Reposition gutter spouts to divert water from the foundations.
- Modify the slope of the ground around foundations.
- Seal the asphalt covering at foundation joints.
- When possible, check to make sure the foundation drain is working well. This drain may gradually block after twenty years.

6.22 Don't overheat or use your garage to wash the car

A 2 cm heave at the centre of the concrete slab in a garage will not generally do any harm unless it interferes with the flow of water towards the central drain.

Single cracks in the garage slab will not do any harm either. If you think the situation does not require any immediate work, avoid washing your car in the garage and, in winter, be sure not to overheat your garage.

6.23 Sealing cracks

Cracks allow water and air to reach the backfill and this could speed up any potential reactions. Similarly, sulphatic attacks on the concrete mostly occur in areas with the most cracks. Fill in cracks with a concrete repair product or a flexible polymer sealant.

If the cracks seem to result from the movement of the foundation wall, you would do well, when filling them, to remember that, if and when repair work is done, the wall could be repositioned, thus closing up the cracks almost entirely. So, make your filling temporary by choosing an easily removed sealant or by sticking a flexible, watertight membrane over the crack.

If the cracks are still active, a flexible sealant will work better than a rigid one. Use of a product such as epoxy is thus ill-advised, especially since epoxy fillers are relatively expensive.

To avoid problems related to seepage of water into the cracks, you should also fill in the part of the crack extending beneath the surface. You will have to dig all along the crack, usually all the way down to the footing.

Elements to consider in making a diagnosis

7.1 Choosing a professional

When seeking a diagnosis, the criteria to be considered in choosing a professional may vary depending on what the owner wants to do.

Professional help may be required in order to:

- Check the cause of damage, specify the repair work required, and gage the urgency of doing the work.
- Take legal action against the seller of the building or the contractor, after damage appears in the building.
- Check for the presence of pyrite and the swelling potential of the backfill in a building which is to be put up for sale or before finishing the basement of one's house.

ACQC advises against calling on a contractor to make a diagnosis or take samples of the backfill.

When there is already visible damage and repair work is being planned, the owner could hire an independent professional such as an engineer, an architect or a building technologist. The mandate of this professional might simply be to make a visual inspection based on which the owner could be told whether he needs to take action and how to go about it. Just as a general practitioner in medicine can refer you to a specialist, this professional could also recommend taking samples for laboratory analysis before drawing any conclusions and making any recommendations.

It is especially recommended to first consult a professional if certain symptoms indicate some other problem with the foundations not connected with swelling backfill.

Always check whether the expert is covered by professional liability insurance specifically related to this kind of mandate and whether he has the experience required to carry it out.

The members of ACQC have access to our recommended professional service.

Test laboratories also have professionals on staff who would be competent to handle a general diagnostic mandate. The owner will, however, have to let the laboratory know from the start that he is seeking a general inspection and not only an analysis of the backfill. In the latter case, laboratories usually dispatch a technician to the site, whereas, for a general inspection, a professional is sent, with the higher costs this would normally involve.

For the buyer of a building which is already damaged who is contemplating legal proceedings against the seller or builder, it is better to mandate a structural engineer who can assess the damage, make a report based on laboratory analysis, and testify in court as a building expert, if and when the case is brought to trial. It should be noted that most test laboratories have engineers on staff who can fulfill this kind of mandate.

As before, it is strongly advisable to state clearly from the start that the results of the mandate could be used in a court case and to consult your lawyer before choosing a consultant, in order to make sure that the professional has the experience and the competence required to be credible in court.

For a building being put up for sale or before finishing the basement, analysis of the backfill by a test laboratory accredited by ACLE will show whether the backfill has a swelling potential.

If no real estate transaction is being planned and you want to test the backfill strictly for your own knowledge, for example, before finishing your basement, you could save sampling costs by collecting the samples of the slab and backfill yourself and taking them to the laboratory. Contact the laboratory to find out what procedures you should follow.

7.2 Laboratory analyses

The CTQ M-200 methodology proposed by the *Comité technique québécois d'étude des problèmes de gonflement associés à la pyrite* establishes guidelines for sampling and analyzing backfills.

The *Comité technique* has drawn up a list of accredited laboratories capable of sampling and analyzing backfills. These laboratories must belong to the *Association canadienne des laboratoires d'essais*.

Laboratory analyses will show:

- The petrographic composition of the backfill (petrographic indicator of swelling potential).
- The grade of the backfill (size of stones it contains).
- Whether or not the stone contains pyrite and how much.
- If the backfill shows signs of sulphation.
- Approximately how far the reaction has progressed.
- The thickness of the concrete slab and its degree of sulphation.
- The type of natural sub- soil under the backfill.

In carrying out its analysis, the laboratory will sample the concrete slab, the backfill, and the sub-soil under the backfill, and check for the presence of a vapour barrier. For residential buildings with garages, two samples will generally be required.

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LABORATOIRE DE CONSTRUCTION 2000	*(450) 662-7535*
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LABORATOIRES D'EXPERTISES DE QUÉBEC	*(418) 845-0858*
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- employ professionals from various disciplines needed to address the problematics of the building industry
- include professionals that qualify as expert witnesses before the courts
- are ISO 9000-certified
- are covered by professional liability insurance
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The analysis results are interpreted by the laboratory which then issues an opinion on the backfill's swelling potential and, when possible, on the ratio of the reaction having already taken place compared with that still to come.

The laboratory's opinion is based on several factors: it should never rely solely on the petrographic indicator of swelling potential. The owner should thus beware of giving credence to beliefs classifying the seriousness of problems only in terms of the petrographic evidence. For further information, consult the CTQ M-200 protocol and its appendices. These documents can be obtained from the *Société d'habitation du Québec* (1-800-463-4315) from some municipalities, and from the ACQC Internet site: www.consommateur.qc.ca/acqc.

Global synthesis of results should be done by the expert who did the first visual inspection of the damage. This could be, depending on the situations described in the section above, either an independent professional or a laboratory professional.

7.3 Work recommended

The work to be done should be recommended by a building professional, taking into account all of the building's features, the budget, and the owners intentions. It must also indicate any risks associated with each solution recommended. This recommendation should take into account:

7.31 The age of the building

The age of the building is an important factor in evaluating the risk of future damage and may influence decisions concerning the work to be undertaken. Even if it is the combined conditions of humidity and oxygen which will determine the pyrite's rate of oxidation, the percentage of backfill oxidation in a ten-year-old building will generally be less advanced than in a structure built 25 years ago.

7.32 Damage to the building

In several situations, there is only cosmetic damage, which some people find acceptable even if it lowers the value of the property. In this case, it would be possible to make temporary repairs and wait to see how the phenomenon progresses.

7.33 Owners' future projects

You might take different decisions with regard to repair work depending on whether or not you are planning to sell your property, finish the basement or not, etc. Your financial situation is also, obviously, an element to consider.

Repair work

8.1 Typical solutions

If the backfill is still in the process of swelling, the only sure solution to put a definitive stop to the problem is to remove the slab and the backfill and put down new "DB" certified backfill with no swelling potential.

Simplified general specifications are shown below as an example. Some elements may vary from one building to the next. To increase the reliability of the repair solutions, rely on the specifications of a building professional.

Note that some of ACQC's recommendations aim at higher than average quality of work and may entail higher costs. This should be taken into account when comparing bids, especially if negotiating a real estate deal or court claim.

Simplified general specifications

For garage slabs, one must:

- Break up and remove the concrete slab.
- Excavate all the existing pyritic backfill, if necessary all the way down to the base of the footing. Also excavate the natural sub-soil down to one metre beneath the level of the existing slab (but no deeper than the level of the footing). (See sketch)

- Place a permeable, geotextile membrane on the ground to prevent the backfill from mixing with the soil (when the natural ground so requires or when net-graded stone is used).
- Backfill with "DB" certified material: either class A sand; 5-to-20 mm or 10-to-20 mm crushed stone, compacting by successive layers not more than 15 cm thick; 14-to-20 mm stone net (ACQC recommends compacted 5-to-20 mm or 10-to-20 mm stone or 14-to-20 mm stone net).
- Put down a polyethylene vapour barrier at least 0.30 mm thick, overlapping the vapour barrier 30 cm next to the joints.
- Put down #6 chuck, 6" by 6" metallic mesh.
- Pour a 10 cm thick, 25 MPa concrete slab with 5 to 8% of the air occluded (NB: additional protection against sulphatic attacks can be obtained for about $100 extra by ordering sulfate-resistant concrete from the supplier).

For cracked walls, one must:

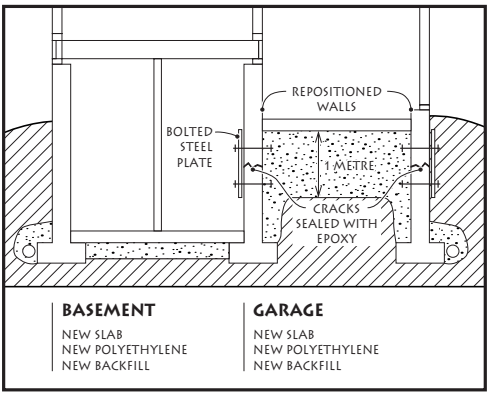
- Straighten the foundation walls with tie rods (if necessary).
- Consolidate the foundation walls with steel plates (if necessary).
- Seal all along the cracks from the outside, using epoxy or urethane.

Straightening the foundation wall with tie rods

For basement slabs, one must:

- Remove interior partitions and false wood floors (in some cases, some of the basement components could stay on place, thus reducing costs).
- Break up and remove the concrete slab.
- Excavate all the existing pyritic backfill. If necessary, also remove the natural subsoil so that total excavation goes down 10 cm beneath the level of the slab.
- Repair the foundation cracks from the outside, if this is needed.
- Place a permeable, geotextile membrane on the ground to prevent the backfill from mixing with the soil.

- Back fill with uncompacted, "DB"-certified, 14-to-20 mm crushed stone.
- Put down a vapour barrier at least 0.30 mm thick, with at least 30 cm of overlap, next to the joints.
- Place 2.5 cm extruded polystyrene insulation (optional).
- Put down #6 chuck, 6" by 6" metallic mesh.
- Pour a 10-cm thick, 20 MPa concrete slab (NB: additional protection against sulphatic attacks can be obtained for about $100 extra, by ordering sulfate-resistant concrete from the supplier).



8.2 Self-bearing garage slab

For garages, it is possible to remove the concrete slab and the backfill and replace them with a self-bearing reinforced concrete slab. This solution offers the advantage of providing up to 1.5 m of storage space beneath the garage.

If the foundation walls have been weakened by cracks, this solution should only be envisioned if advised by a structural engineer. The cost of this work is also very high and must include insulation, an access hatch, and natural ventilation. This type of work must always be specified by a structural engineer.

8.3 "Temporary" repair solutions

In cases of minor problems, when foundation walls are not affected or when dealing with properties more than 20 years old (where oxidation of the pyrite seems very slow or very advanced) or simply for economic reasons, some owners will seek less permanent solutions which they can carry out themselves at less cost. Here are some solutions that might prove satisfactory in some cases and for some people.

Before envisioning any of these solutions, the owner should seek the advice of a building professional who will see if the solution is appropriate and what precautions should be taken in carrying it out.

Whatever the solution chosen, the owner will have to carefully fill in the cracks in the foundation walls.

BEWARE: These solutions must never be used in an attempt to camouflage a problem in order to get rid of it by selling the property. The new buyer who discovers that the seller deliberately did work to camouflage a problem will have the right not only to sue the seller for latent defect but for damages and interest as well.

Once again, the most pristine honesty is *de rigueur* in real estate transactions.

For garages

- Break up the concrete slab (or simply the damaged sections).
- Put down polyethylene sheeting at least 0.30 mm thick.
- Redo the concrete slab, with no reinforcement, preferably using sulfate-resistant concrete.

OR

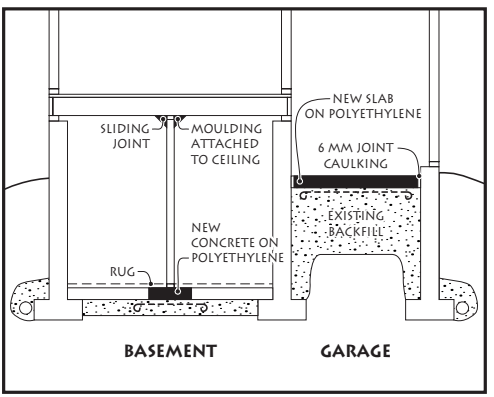
- Break up the concrete slab.
- Put down polyethylene sheeting at least 0.30 mm thick.
- Level off with 2 cm of sand.
- Put in paving. Paving has the advantage that it can be installed by the owner himself. Moreover, it will shift with slight movements without deteriorating. It can also be releveled after ten or twenty years, if it becomes too deformed.

  NB: With a paved garage floor, the car should no longer be washed in the garage.

For basements

- Saw cut and remove the concrete slab where it is deformed or hollow.
- Place polyethylene over the existing backfill.
- Pour a new concrete slab, using, preferably, sulfate-resistant concrete.
- Place over the concrete a non-vapour-barrier, woven synthetic rug, with a checkered fibre glass backing (no natural products).
- Construct shorter partitions with no top plate, so that the half-timbers can slide into the ceiling without making cracks nor damaging the upper floors. Use vertical boards to cover the partition and a moveable upper moulding.

OR



- Saw cut the slab around the walls, as close as possible to the interior wall covering.
- Break up the slab and remove the debris.
- Install temporary support for interior partitions (if needed).
- Excavate the pyritic backfill (partially or entirely).
- At the centre of the cave, pour a footing on the full length of the natural sub-soil.
- Pour a footing under the partitions (if needed).
- Cover the ground with a rather thick vapour barrier, sealing the joints and the rim.
- Add a layer of sand to ensure that the vapour barrier will stay in place.
- Construct a floating wood floor with joists; the joists should rest on the uncovered portion of the foundation footings and on the new footing poured at the centre of the room.

You will have to respect the standards applying in your municipality with regard to the span of the joists and the quality of the wood used for flooring; adequate ventilation under the floor may also be required in order to prevent any problems with rot.

8.4 Other pieces of advice

Norms and permits

The contractor will have to comply with the rules of trade and requirements in section 9 of the *National Building Code,* as well as with the municipal and provincial by-laws in force.

Check with your municipality to find out whether a renovation permit is needed for this type of work. Stipulate in the contract whether it is you or the contractor who is responsible for obtaining the permit.

For slab in the basement or self-bearing slab in the garage, an architect's or engineer's drawing may be required by the municipality. This drawing with general specifications should be submitted to two or three contractors to ask for bids.

The contractor should not begin the work before obtaining the permit. The owner must bear the cost of providing any architectural or engineering drawings and specifications required to obtain these permits.

You may also need to seek a permit for use of the public domain to place a container for the debris from removal of the slab and the backfill.

Time needed for work

Work of this kind should usually last from three to ten days. If a delay would be prejudicial—for example, if tenants must be relocated during the work—write the dates for beginning and finishing the work into the contract and also provide, in writing, a reasonable penalty in case the dates are not respected.

Consultant's drawings and report

If there are drawings and specifications from a consultant attached to the contract, the contractor will have to carry out all the recommendations specified in these documents.

Unforeseen defects

If demolition reveals defects such as mould or some other problem not covered by the contract, the contractor will have to inform the owner immediately and make a written proposal modifying the work and indicating the costs of the modifications.

Protecting trees and landscaping

The contractor will have to take the necessary means to protect any trees or shrubbery which might be damaged during the work, as well as the garage entrance, fences, pools, alleys, etc.

Handling debris

All the debris and rubble from demolition or excavation will have to be removed from the site within 48 hours or dumped into containers, as required by the laws and by-laws in force.

Interior partitions

Before demolishing an interior partition, the contractor will have to make a visual check to determine the orientation of the joists and to make sure it serves no structural role. If the partition is a structural component, he will have to do what is needed to provide temporary support. The demolition must be done safely.

Isolating the work site

Given the fine dust produced by demolition, the openings, holes, and air shaft between the work site and adjacent rooms will have to be sealed off.

Quality of the concrete

No water should be added to the concrete before or during pouring.

The contractor must ensure five days moist curing of the slab in a temperature of 21° C or more and seven days, in temperatures ranging from 5 to 20° C. Protect the slab from freezing during the full time of the moist curing.

To save on costs, the owner could himself supervise the curing of the concrete. The contractor would then have to instruct him carefully as to how to go about it.

8.5 Choosing a contractor

For garages, contractors specializing in foundations are generally the best choice to do the work. However, in basements where plumbing, electrical wiring, structural or finishing features may be disturbed, it would be better to choose a general contractor to coordinate the whole project.

Before moving on to the tender stage, write down in detail the kind of work required. Send tenders to at least three contractors asking for their written and detailed bids. You should not automatically choose the cheapest bid, but also keep in mind the quality of the work and the materials proposed, the experience and credibility of the contractor, the satisfaction of his clientele, etc.

Beware of sellers who are too "pushy" or who offer "negotiable prices." Remember that, contrary to some beliefs, your signature is your word! There is no legal ten-day period of grace to cancel a contract (except in the case of door-to-door selling).

Before signing a contract with a contractor, check with the *Régie du bâtiment du Québec* (RBQ) to make sure he has the appropriate license for the type of work you want done. You will find the contact information for your regional office of the RBQ in the blue pages of your telephone directory or on the Internet, at the address: www.rbq.gouv.qc.ca. According to new regulations in the *Building Act* , all contractors must display their RBQ license number on their vehicles, in their advertisement, and on their contracts.

If you are not sure about the reliability of your contractor, it would be a good idea to look for an outfit covered by a renovation warranty or bonded by an insurance company. This additional protection will cost a few hundred dollars more, but you will be protected in case your contractor defaults. Check whether the contractor's affairs are in order and if he is properly registered by contacting the guarantor or the insurer directly.

APCHQ warranty plan: (514) 353-9960

ACQ warranty plan : (514) 354-0609

Members of ACQC can use our *Service de recommandation d'entrepreneurs.* Contact us for this information at (514) 384-2013.

8.6 Cost estimates

Even if it is sometimes difficult to evaluate how far down the excavation must go before work is started, it is possible to ask the contractor for a set price based on the excavation depths specified in the general specifications provided above.

Costs may also vary depending on the accessibility of the place where the work must be done.

As a rule, costs to complete the work are estimated at about:

- $4,000 to $6,000 for a single garage at street level
- $7,000 to $10,000 for a double garage at street level
- $8,000 to $12,000 for an unfinished basement
- $15,000 and up for a finished or partially finished basement

8.7 Group contracts

If several of your neighbours seem to be struggling with the same problem as you, you could agree to accord a group contract to a contractor. The possibility of doing several jobs one after the other in the same sector makes for economies of scale which can mean savings of from 10 to 20%.

Group contracts can also be considered for consulting work.

8.8 Supervision of the work

When obtaining the services of a professional or a test laboratory, ask if they are also capable of supervising the work and if their liability insurance would cover such a responsibility. Extra spending on supervision will give added assurance as to the quality of the work.

In case of any problem with your contractor, contact us at ACQC.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DON'T FORGET :
UNDERGROUND WORK ALWAYS COSTS MORE!
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JOIN ACQC AND SUPPORT ITS WORK!

ACQC has members in every part of Quebec. By joining us, you will receive all the Association's services and all the information contained in its files. You will receive *Info-habitation*, the ACQC newsletter, and you will have free access to our service recommending contractors and building professionals, which is reserved exclusively to our members. You will also be helping to support Quebec's **only consumer protection association working in the construction sector.** A strong defence for consumers, make ACQC YOUR association!

YES, I WOULD LIKE TO JOIN ACQC AND SUPPORT ITS WORK!

FIRST AND LAST NAMES

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CITY

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Declaration of individual member concerning ACQC's responsability

I recognize that the services ACQC provides to its members are free of charge. I also recognize that ACQC provides information, recommends contractors, and investigates complaints in order to improve consumer protection. The advice given by ACQC, its staff and its representatives cannot be construed as warranties or insurance and in no way relieves me of my primary responsibility as a diligent and prudent buyer to have recourse to a building professional. In my use of the ACQC services described above, I expressly discharge this association of any liability.

Signature of member

Date

Please enclose a check or money order made out to ACQC: $20 for one year ($100 for a corporate member) and send it to the address below:

ASSOCIATION DES CONSOMMATEURS POUR LA QUALITÉ DANS LA CONSTRUCTION

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Web site: www.consommateur.qc.ca/acqc

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Association des consommateurs pour la qualité dans la construction

ENTREPRENEUR RECOMMANDÉ

(514) 384-2013

ACQC Recommended Contractors

Before recommending a contractor, ACQC makes an in-depth examination of the company. Recommended contractors have demonstrated they deserve the confidence of consumers. They have committed themselves, through a contract with the ACQC, to respect a predefined line of conduct in their relationship with members of the ACQC.

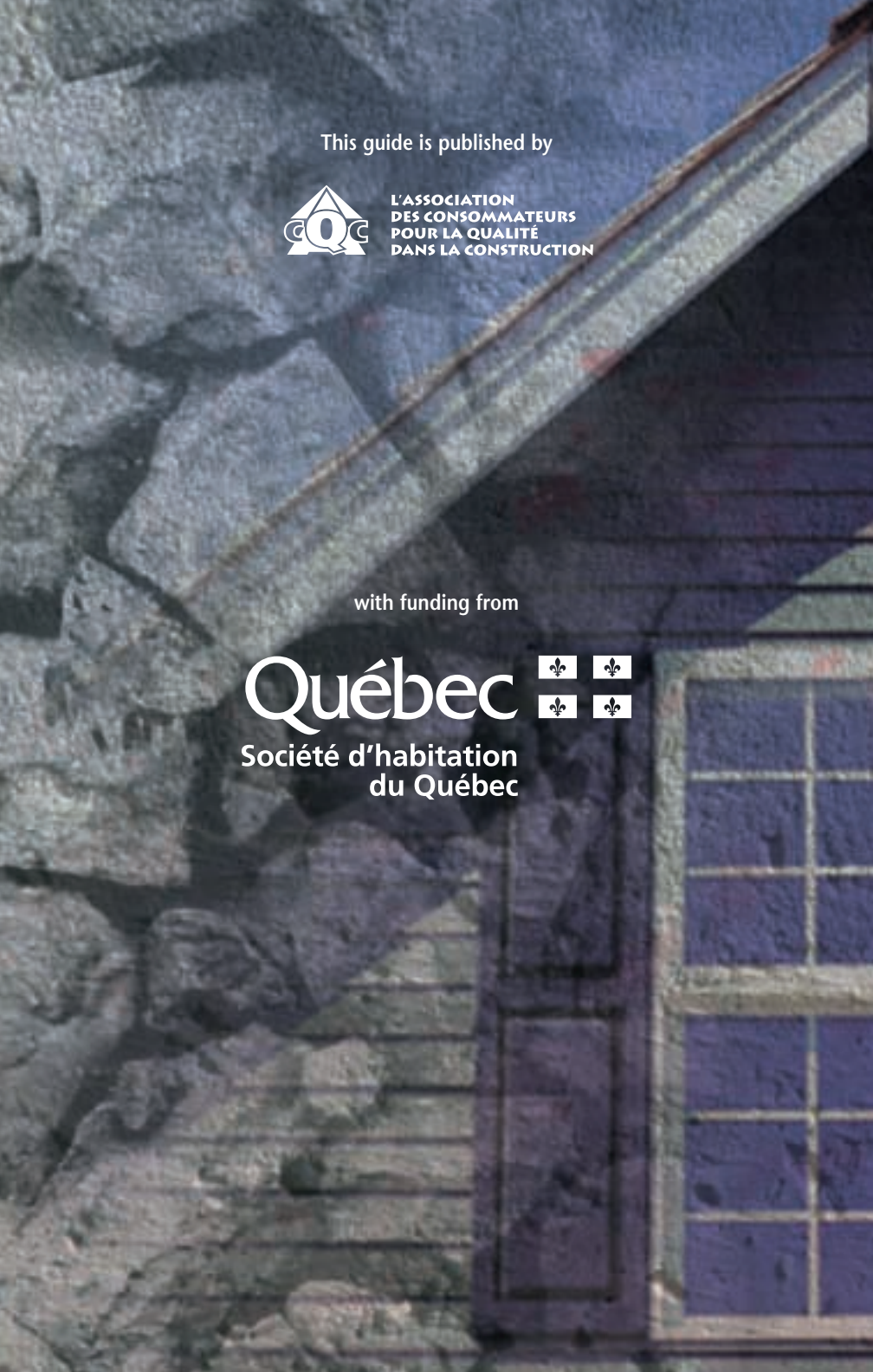
When a problem arise between a member and a recommended contractor, the ACQC may act as a mediator between them.

ACQC Recommended Professionals

ACQC members will find that ACQC recommended professionals offer outstanding expertise to diagnose technical or legal issues, perform a pre-purchase inspection or manage a construction site. Do you require an engineer, an architect or a construction technologist?
We can help you.

PROFESSIONNEL RECOMMANDÉ

ANOTHER EXCELLENT REASON TO BECOME AN **ACQC MEMBER!**



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