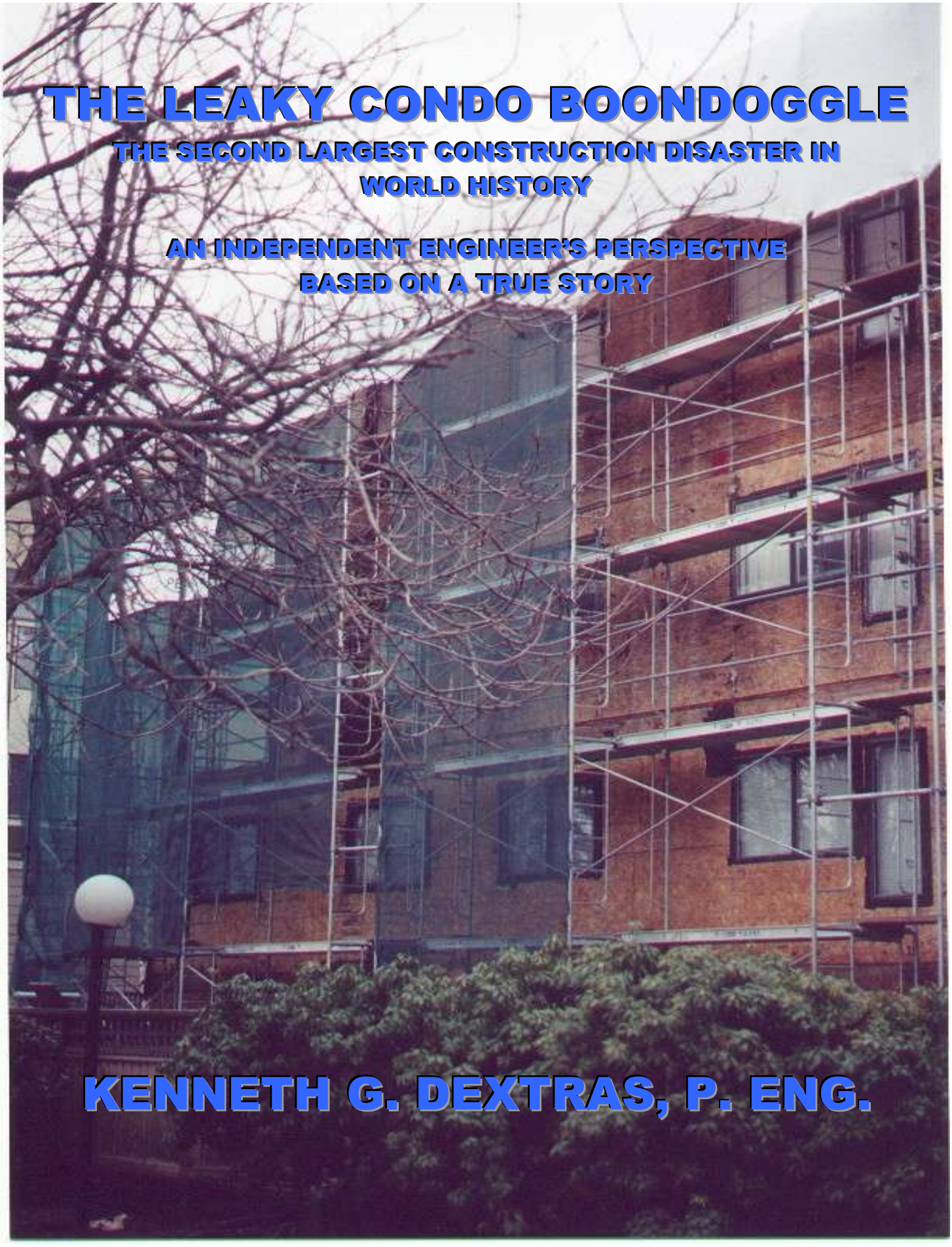

THE LEAKY CONDO BOONDOGGLE

THE SECOND LARGEST CONSTRUCTION DISASTER IN WORLD HISTORY

AN INDEPENDENT ENGINEER'S PERSPECTIVE BASED ON A TRUE STORY

KENNETH G. DEXTRAS, P. ENG.

SOME OF THE WORLD'S LARGEST CONSTRUCTION DISASTERS

Description	*Cost*[1]
1. CHERNOBYL NUCLEAR PLANT, USSR, 1986	$2.7 billion
2. LEAKY CONDOS, VANCOUVER, CANADA, 1990….	**$2.5 billion**
3. THREE MILE ISLAND NUCLEAR PLANT, USA, 1979	$1.7 billion
4. SPACE SHUTTLE CHALLENGER, USA, 1986	$1.2 billion
5. BANQIAO & SHIMANTAM DAMS, CHINA, 1975	$200 million
6. TETON DAM, IDAHO, USA, 1976	$96 million
7. VAIONT DAM, ITALY, 1963	$75 million
8. TACOMA NARROWS BRIDGE "GALLOPING GERTIE", USA, 1940	$14 million
9. QUEBEC BRIDGE, CANADA, 1907	$2 million
10. ST-FRANCIS DAM, CALIFORNIA, USA, 1928	$1.6 million

[1] Cost to replace or repair and make good

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FOREWORD

Since my graduation from McGill University in 1976, I have been a practicing Civil Engineer (in heavy construction) from coast to coast in this great country of ours. Like the vast majority of my colleagues, I was not involved in wood frame "engineering" (if you can call it that) for the simple reason that the whole subject is, to put it bluntly, an oxymoron. All low rise wood frame buildings are not designed using the traditional engineering approach of mathematical analysis followed by a verification of the results of same against practical rules of thumb or, to use a more common term, "codes". Rather, like the work itself, the design is literally pieced together using rules of thumb only. There is no analysis involved at all and so it should come as no surprise that the so called "design" of the frame (and everything attached to it, commonly known as the building envelope) has, for many years, been delegated to the architect's draftsman with very little professional engineering involvement whatsoever. This in itself is perfectly natural and as long as no serious changes are contemplated in the design, there is no need for formal P. Eng. involvement at all. To quote an old adage : if it ain't broke, don't fix it !

For all the above reasons, I had absolutely no intention whatsoever of ever getting involved in the wood frame industry. Up until the spring of 2000, I still considered it the low-tech end of the engineering business and like most people, I attributed the leaky condo construction disaster to its most simple and probable cause: poor workmanship and lack of inspection. Again, like most people, I never doubted that the current "piecing together" was sound. In fact, it didn't really look much different from what I had seen my whole life and this goes back to my first real experience with it – building hunting cabins in the forests of eastern Ontario when I was 12 years old. Through subsequent years, I was vaguely aware that someone in the "rule of thumb" crowd had, at some point in time, imposed a vapor barrier and insulation standard on the industry but my general attitude was: Well, so what ? Surely they know what they are doing. Surely they checked this out thoroughly prior to imposing it – they always do in everything else we deal with in civil engineering as, for example, steel or concrete design.

And so, because of this, I was buying into the popular theory without much question until, in April 2000, a series of articles appeared in the Vancouver Sun that jarred me out of my complacency. These articles were paid for by the wood frame industry and essentially amounted to a propaganda series whereby the "players" of this industry were patting each other on the back and telling each other how great they were. I must admit it just rubbed me the wrong way. If these people are so great I thought, and they're doing such a good job, how come we've got a $2.5 billion problem on our hands with no end in sight ? However, on the positive side, there was one interview that did make some sense. This interview was with Mr. Gordon Spratt, P. Eng., a fellow McGill graduate twenty years my senior, whom I had knowledge of for many years but had never met. The gist of the article is as follows and I quote:

> "Like many of his engineering colleagues, Spratt explains that leaking buildings always have been with us and always will be. 'I can look from my office here and see 20,000 buildings. Every one of them leaks, every time it rains and the wind blows. But then they dry out before anyone even notices. They always will; it's just a matter of how you manage it.'"

Very interesting, I thought. How *do* they "manage it" ? Obviously it had been "managed" before and with great success and so, how was this done and how is it different from today ? Maybe that's the problem. Maybe we're not "managing it" properly or maybe, just maybe, we're not really managing it at all. Maybe we never have ! As it turns out, I happen to live in a very old housing district called Queen's Park in New Westminster and so all I had to do was to walk a few blocks from my home to find the answers to the above questions. As you will soon discover, this walkabout made it abundantly clear that the technical reasons for The Leaky Condo Boondoggle are not complex at all. On the contrary, they are really quite simple. What is complex is the maze of political and business structures that have been erected during the past 30 years to protect the backside of those responsible for it. Is it a cover up? or a conspiracy? or just plain carelessness? You be the judge.

Chapter I

THE ANSWER IS STARING US IN THE FACE

The modern condominium is, from an Engineer's perspective, nothing more than a tenant owned "apartment". It would seem therefore, that to determine how building envelopes were "managed" in the past, the study of old apartment buildings is the ideal place to start. Fortunately, within a one mile radius of my home in New Westminster, many examples of same exist and, in all cases are still providing inexpensive accommodation for the tenants *and* are making money for the landlord. Photographs of some of these are shown in Appendix I.

All of these buildings essentially possess most of the so called classic symptoms of modern building envelope failure, namely:

1. Stucco

2. No overhang

3. Extremely poor and ineffective flashing over tops of windows. Sides and bottom of same: un-flashed. Also note that all of these original 75 year old windows would never pass a modern "leakage" test.

4. Number of hairline cracks in stucco: millions. Some cracks are so large you can stick loonies in them (see photos).

5. Condition of "kraft" building paper is extremely poor; either non-existent or crumbles to the touch.

6. No "rainscreen". A small and extremely crude drainage cavity is provided (by default) by using wood lath instead of steel mesh. The drainage capacity is severely limited because the lath cavity is 2/3 full of wood and/or stucco. Note that by the late 1930's, steel mesh becomes prevalent in most buildings and so the dreaded "face seal" technique is now commonplace. Net effect of that on durability: zilch.

7. Amount of "maintenance" performed on cladding, windows etc, over a 75 year period: almost next to nothing. Essentially the buildings were merely painted every 8 years or so. Note that this has already happened to one of them since the photos were taken almost 3 years ago.

The general conclusion to be drawn from all of the above is quite obvious. In a hard driving rain storm, these buildings not only leak, they leak like sieves ! But they have lasted 75 years and counting, so what gives ? There is no doubt, as Spratt said, they are able to "dry out before anyone notices", but how exactly ? Perhaps some of the details shown on the original 1925 drawings might shed some light on the mechanics of this.

Upon returning home, I called an old acquaintance of mine, Mr. Archie Miller. Archie is the (now retired) curator of Irving House, the Royal City's official museum. I asked if by any chance he had kept some of these old drawings and as luck would have it, he had. "They're in a file called Westminster Apartments" he said, "just ask Ellen at Irving House for that file. They should still be there. Also, there are some articles in old issues of the Columbian newspaper that are kept on microfiche at the library. You might get lucky and find the original builder or architect. They might still be around". I thanked Archie and my first stop was at the library because it was closer and on my way to Irving House.

The Columbian articles were there all right and yes, the original builder, architect and some of the major sub trades were mentioned (mostly in ads) but unfortunately, all were long gone. It was interesting to read some of the "features" of the buildings such as "central heating" or "a common laundry capable of handling many loads per hour" or "fold out beds" etc… but one thing did strike me as a bit odd. There was no Engineer mentioned, anywhere. The significance of that would come much later.

At Irving House, Ellen found the Westminster Apartments file in no time at all. Sure enough the folder contained some of the original blueprints and with their classic white lines and text on dark blue background, two words immediately came to mind – elegant simplicity. A partial copy of same is provided in appendix I and on the back cover of this book.

After a brief review of the standard building section, it became abundantly clear how drying occurs. The key to it is to be able to see, with the mind's eye, what is *not* shown. The first thing to understand is the concept of differential pressure. Generally speaking and for any building, the internal pressure is slightly greater than the external pressure – especially during the heating season. Looking at the drawing in more detail now, the next thing to observe is that the stud cavity is empty (no insulation) and the interior face of the studs is not sealed with a plastic "vapor/air barrier". The interior finish (detailed elsewhere) is lath and plaster which may or may not be somewhat air impermeable depending on how well it was applied and maintained. However, what may not be so obvious to the untrained eye is that the majority of exfiltrating air does not enter the cavity through the plaster – it enters the cavity by "sneaking in" under the baseboard. As anyone who has been in an older home can testify, this wall/floor joint is very imperfect and most certainly not airtight.

Finally then, we can now see how the true drying mechanism works. Dry interior air enters the cavity via the baseboard/floor joint, picks up any moisture that may be present in the stud cavity, escapes to the exterior via joints in the shiplap sheathing and finally exhausts itself to the (slightly lower pressure) exterior atmosphere. In the final analysis, this conservative "fail safe" design approach is all that is necessary to deal with *any* amount of moisture ingress and make this "building envelope" last 75 years and counting.

The irony of all of the above is that this very positive benefit was purely accidental. It was not a result of a conscious decision by a "designer" (who ever that was) but rather a mere consequence of market forces: fuel was cheap and insulation and vapor barriers were expensive. It's that simple and it essentially remained that way for the next fifty years.

Contrary to popular belief then, these buildings have lasted a very long time not because our forefathers were such great builders but because market forces *allowed them to breathe*. In fact, when you take the craftsmanship out of the equation (which we all enjoy looking at, but is nothing more than architectural "fluff" from the strict point of view of building performance) what you will find is that the *workmanship* of the 1920's is not all that different from what you see today. It's just as "rough and ready" as it ever was.

This now leaves us with two unanswered questions: How much "breathing" is actually going on and how much "heat loss" is associated with this exfiltrating air ? The answer to these questions is next.

Chapter II

THE PRELIMINARY INVESTIGATION

The answer to the first question "How much does it breathe?" was, fortunately, very close at hand. My search began at the most obvious place – the Canadian Mortgage and Housing Corporation (CMHC) office in Vancouver, where I spoke to a senior research analyst by the name of Mark Salerno. He could not remember the air exfiltration figures off hand but he was quite sure they could be found in CMHC's newly minted "Best Practice Guide". I immediately made arrangements to acquire this guide along with copies of the recently published Barrett Commission Reports on the whole leaky condo controversy.

Sure enough, on pages 3-13 and 3-17 of the Guide, the relative air exfiltration values were given as follows:

1. "Older Home" standard (no insulation & no vapor barrier) - 1.4 liters / sec / sq. meter

2. "Newer Home" standard (fully insulated & with vapor barrier) - .02 liters / sec / sq. meter

Doing the math yields an astounding number : the newer standard (2) is **70 times** more airtight than the older standard (1) ! Oh, oh. I immediately called Salerno to make sure that there was no misprint in the Guide and he confirmed that the figures were correct. I told him that in my opinion, the order of magnitude of this change was so large that the root of the problem is probably not leakage per se but *suffocation*. "It is obviously why our older buildings survived with such flying colors" I said and he replied, "Yes, that's true but because they weren't airtight, they also cost more to heat". "Ok" I said, "but how much more? How much are we talking here – 50%?, 100%? or what?" " I don't know exactly," he replied, "but I'll call Ottawa and see if I can dig up some old reports on this and I'll let you know." Over the next year and a half, Mr. Salerno was to send me a great deal of very valuable (and revealing) information but on this specific point, he never responded directly.

As it turns out, he didn't have to. The correct order of magnitude to the heat loss question was again right here in my own back yard – literally. By simply comparing the annual volumetric energy consumption (in $ per cubic foot of interior space) of my own home (built in 1990) to that of my next door neighbor's home (built in 1925), I was able to determine that my modern standard was only 14% more energy efficient than his older one. Similarly, I was able to compare the average annual energy consumption of an apartment in the Carlton apartment building (also built in 1925) to that of your typical modern condo and found that in this case, the modern advantage was only 10%.

I realized that these results were unrefined and approximate but nonetheless, even at double those rates, it would be cheaper to simply turn back the clock, pay the extra heating bill and forget about the whole thing ! However, as a long term solution, this is probably not a good idea. It seemed rather obvious then, that the practical solution to this little conundrum was to design a system that provided adequate ventilation and minimized heat loss. This is precisely what I proceeded to do.

One would think that under the current dire straights that condominium owners find themselves in, bringing such an innovative solution to the marketplace would be a slam dunk. Unfortunately, precisely the opposite is true. The reasons for this are numerous and quite complex but as usual the corrective antidote is as plain as the nose on your face: it's called *freedom of choice*. More on that later.

In the interim, I met a gentleman by the name of James Balderson, chairman of COLCO, the Coalition of Leaky Condo Owners in Vancouver. During the next few years Mr. Balderson and I were to have numerous discussions on this issue. Here's an example of one of our early conversations which set the stage for what was to follow:

J.B. "Well Ken, the Barrett Commission says that *all* building envelope failures in the sample study were *not* built to code.

K.D. You mean the code requirements for the "exterior" work don't you ?

J.B. Yes, I guess so. What else is there ?

K.D. There are also the "interior" code requirements and *all* of these failures were built to a code which mandated an *airtight* standard of .02 liters/sec/sq. meter instead of the old standard which effectively allowed 70 times more air to pass through it. If the code authorities had not forced this ridiculous standard on everyone involved, from the architect on down including you, the purchaser, this would never have happened.

J.B. So what you're saying is that this old fashioned "exfiltrating air" was actually doing some useful work !

K.D. Yes indeed Mr. Balderson, yes indeed.

J.B. You know Ken, I sat through most of those Barrett Commission hearings and not once did I hear it explained in such plain and crystal clear "kitchen English". Why would this be so ? Don't all these so called experts know this ?

K.D. I don't know James. But I'll tell you one thing, come hell or high water (pardon the pun), I'm going to get to the bottom of it and when I do, I'll let you know."

I figured it would take me no more than a few months to get there. It took me almost three years.

Chapter III

THE DETAILED INVESTIGATION

In the spring of 2000, I requested a number of reports pertaining to the drying of code built walls from CMHC and I received a variety of these over the next two years. The following is an encapsulation of approximately 1000 pages of government reports which I have read over the past three years. It summarizes the pertinent facts that can lead us to a better understanding of how this whole debacle occurred. I have broken it down into five reports and have arranged them in chronological order as follows:

Report No. 1 entitled: "Moisture in Canadian wood-frame construction: Problems, Research and Practice from 1975 to 1991"

Quoting from page 12:

> "A document by Latta [50] in 1973 summarizes the theory….. An analysis of steady state vapour pressure gradients and flow, to and from potential condensation planes under winter design conditions, based on diffusion theory, was recommended as a basis for determining the potential for drying of components that might become wetted."

My comment: Ok, so as far back as 1973, CMHC knew that wetting would be a problem but assumed heat diffusion would be sufficient to take care of it. I would have presumed that they would have verified this assumption in detail *before* instituting any changes, but they did not.

Quoting from page 14:

> "Impact of Energy Conservation Programs:
> The single most significant factor influencing building research, technology and practice for more than a decade, beginning in 1975, was the energy crisis. This resulted from increased oil prices initiated by the OPEC cartel in 1974. In the government programs that followed, aimed at security of supply and self-sufficiency, energy used for buildings (both existing and new) was a primary target for conservation. Conversion from the use of oil to other energy sources was also a priority.
> At the federal government level Energy, Mines and Resources Canada (EMR) was given the primary mandate to implement the energy policy. New Branches were established and new programs with major budgets were initiated. The principal ones concerned with residential buildings are summarized in Appendix B. Energy programs were given one of the highest priorities by the government and all government agencies were expected to respond accordingly, under overall EMR direction. Staff at EMR were recruited for their initiative and their commitment to achieving energy objectives. They were given substantial responsibility and authority. For the most part they did not have extensive experience in building science and practice. They were generally results-oriented and prepared to take risks to achieve objectives."

My comment: *Risks* ? Risks to whom ? In the context of a wood framed building, the only risk would be to the occupant/owner of same. What this tells us is that in 1975, the federal authorities were fully aware that they were putting the owners of wood frame buildings at risk "to achieve [*their*] objectives."

Quoting from page 18:

> "The potential for dissipation of moisture (drying) in building components, during the spring-to-fall period, is significantly less in some parts of the Atlantic provinces than in other parts of southern Canada, with the possible exception of coastal B.C."

My comment: This comment is being made in 1990, which is 5 years *after* the most significant building code change ever (see next section). So what about B.C. ? It is obviously the worst case scenario and yet no one has bothered to investigate it. No one seems to care.

Quoting from page 27:

> "Code Changes – 1985
> - all joints in vapour barriers are to be sealed, or lapped 100mm over framing members.
> - holes through vapour barriers for services are to be sealed.
> - a new appendix refers to the importance of air leakage and the need to prevent it, including air leakage around service penetrations, at wall-floor-ceiling intersections, and through gaps due to lumber shrinkage."

My comment: This is the straw that broke the camel's back. It essentially gave the municipal inspector the authority to force the builder to "seal" this whole thing up, tight as a drum. The worst part about it is that when the code changes were mandated, there was still no full scale testing to support the original (1973) assumption that the "diffusion theory" will be sufficient "for drying of components that might become wetted". That would come later. Unfortunately when it did finally arrive, it was too late to *undo what they had done.*

Quoting from appendix I, page 6:

> "What Moisture Problems or Envelope Design Issues Require Improved Performance Predictions Through Modelling ?
> - Models should assist the user in establishing what is important in a particular systems context (for example could a vapor barrier be eliminated from a particular system within a geographic region)"

My comment: This statement is being made in 1992 after the federal building code authorities had forced the vapor barrier standard on everyone back in 1985! By the way, the only reason this second-guessing was taking place at this point was that by now, the mold spores were in full bloom in: *British Columbia*.

Report No. 2, entitled: "Drying of Walls in Atlantic Canada", November 26, 1987

This experiment, like all subsequent ones performed by CMHC et al, were undertaken on "test huts" and it is the first official attempt at verifying the above mentioned diffusion theory of drying. Unfortunately, a clear answer to the standard question: "Did these code built walls dry out?" is not given in plain terms. Essentially the bulk of it is a bunch of statistical mumbo jumbo that tells us very little. However, scanning through the drying rate curves, it appears that they haven't dried out because the vast majority of test points are still above the critical moisture content of 20% (for mold growth). Also, in an obscure section called "Visual Inspection" it looks like some very serious mold growth has indeed occurred and I quote directly from page 68 in Section 5.7:

> "The evidence of damage due to the presence of free water and fungal organisms, is indicative of the real potential for structural degradation in moisture laden walls."(underline mine)

My comment: The above is an extremely serious finding with huge repercussions. It blows the lid off "diffusion theory" as an acceptable drying mechanism. However, instead of alarm bells going off at all stations in Ottawa, it is deafeningly quiet. In fact, this finding is completely ignored in the "Discussion and Summary" of this report ! Also, the date of this experiment is 1987 which is two years after the major code changes. Therefore, I think what we're seeing here is the beginning of bureaucratic "damage control".

Report No. 3, entitled: "Drying of Walls Prairie Region", University of Alberta, 1990

At first glance, this report is much more positive and to the point. The last paragraph of the summary reads as follows and I quote:

> "Overall, in a prairie climate, any significant moisture in a wall cavity will produce sustained cavity/outdoor vapour pressure differences that will result in drying throughout the winter period. In the prairie climate, none of the exterior wall assemblies produced cavity conditions that posed a serious problem for the long term integrity of the wall."

My comment: Ok, this is good and since a "prairie" climate is just one notch up from a desert climate, the result is completely expected. Also on the positive side, these researchers included a "vented" cavity in their testing. Obviously this was done to provide a possible answer to the proverbial question: Well, what if the wall cavity doesn't dry out - then what ? The negative results of the 1987 Atlantic Canada study, now 3 years old, probably played a large role in adding this to the test program but in any event, it was nice to see that finally, someone had their thinking caps on. The venting provided in this cavity was with uncontrolled *exterior* air and although it cut the drying time by an order of magnitude, there were some very serious warnings issued against the use of this exterior air technique.

What it boils down to is this: if the uncontrolled exterior air is damp enough, then *rewetting* can occur. (In fact, looking at the drying rate curves, one can see that this actually happened during the experiment for a short period of time). Obviously then, this may *not* be a good practical solution for a "maritime" climate ! Also, the researchers suggested that serious condensation problems can occur if the interior surfaces are not "carefully sealed". Bottom line: this is not a good practical solution and under the right circumstances, is a recipe for disaster. Believe it or not, some people in B.C. are not only still advocating the use of exterior air venting, they are actually doing it. The building on the front cover of this book is a case in point.

Despite the aforementioned negative result on a "good try", at least these code walls dried out - or so it seems. There is no mention of mold growth in the summary or the conclusions and yet, there is this short, one paragraph section (3.5) entitled: "Microbiological Tests" and the last two sentences of the paragraph are as follows:

> "However, at the end of the test period when all cavities were exposed, there was evidence of microbiological activity. Wood samples were taken by Lynne Sigler (University of Alberta, Devonian Foundation) and sent to Forintek Canada for analysis. Forintek's report is included in Appendix B."

So far this sounds innocuous enough and there is certainly no cause for alarm until you actually take the time and trouble to read "Appendix B". The pertinent passages of this appendix B (Section 4.0 Discussion), are as follows:

> "The studs and paneling of many of the wall panels are heavily colonized by fungi. ….. However, of the fungi isolated, we believe that the relatively high incidence of *Paecilomyces variotti* may be a cause for concern. ….. In contrast to the isolations made at time zero for the Waterloo hut, some possible wood-decaying basidiomycetes were isolated from the studs of the Alberta test hut. The significance of this is unknown, although it indicates that decay is possible under the moisture conditions present."

If this isn't a "cavity condition that poses a serious problem for the long term integrity of the wall" I don't know what is. This confirmed my original suspicion that without active "management" of the air in the stud space, a mold related *ticking time bomb* is set to go off in *all* airtight wood frame buildings in North America. The only thing that varies is the length of the fuse. For your information, this problem is also cropping up in the southern climates of Texas, California, Louisiana, etc., obviously under different conditions but for precisely the same reasons : the walls can't breathe.

When I first read this appendix, I immediately called one of the authors of this report, a Mr. Tom Forest (who is now Dr. Forest and still at the U of A), to get some sort of logical explanation for what appeared to be a deliberate cover up. I left voice messages and told him exactly what I wanted to talk to him about. He never returned my calls.

Report No. 4, entitled: "Stucco Clad Wall Drying Experiment",Vancouver, 1999

Twenty five years after the initial "taking of risks" and 14 years after the point of no return (the 1985 code changes), the CMHC Research & Development team finally arrived where it was needed most in the first place: Vancouver, B.C. The purpose of this drying experiment was to determine the drying rate of code built walls in a "maritime" climate, especially "Rainscreen" walls. For those of you unfamiliar with this term, a "rainscreen" is nothing more than a simple drainage space between the building paper and the stucco. It's nothing new; it's a borrowed detail from brick buildings that has been around for centuries. The industry has done a masterful job of selling this as "new technology". This is especially true here in Vancouver, where, as you may or may not know, there are very few brick buildings.

The basic results and conclusions of the above experiment are as follows:

- Walls did not dry out after $5^{1/2}$ months.

- Improved drying of water that penetrates into the stud cavity is **not** a benefit of the rainscreen design.
- Moisture movement in panels was very limited.
- When the inner finish and insulation were removed, dark staining was observed at the base of the plywood sheathing of each wood frame specimen.

The basic recommendation of the report was:

> "This experiment has shown that design for effective rainwater management is important since it is essential that little if any water be permitted to get into the stud cavity." (underline mine).

Well, at least this time, they had come clean with it. Unfortunately, it was a little late in the day and the recommendation was, for all intents and purposes, impossible to achieve in the *real world*. Over the 75 year lifespan of a typical wood framed building, it is not physically possible to keep "any water from getting into the stud cavity". There is no such thing as "super cladding" in the real world and if that is what their airtight design requires, then they have made a mistake. Obviously what is needed is to design a proper *failsafe* system that can deal with it and as you will see later, this is precisely what I have done.

Immediately after its initial release in April '99, CMHC pulled this report apparently because of "inadequacies in the test program". However, a few months later, an abridged version was issued (as Technical Bulletin 99-107) under their own "Research Highlights" program. My first discussions with CMHC began in March 2000 and obviously this technical bulletin was available but CMHC never provided it. I received it from Gordon Spratt a year later (April 14, 2001 to be exact). He had inadvertently stumbled onto it while flipping through his rather large R&D file on this matter and knowing of my interest in this issue, he forwarded me a copy of it. Why CMHC would deliberately choose to withhold this information I can't say for sure but in hindsight, I strongly suspect it had a lot to do with the last line of this technical bulletin.

Under the heading of "Possible measures to promote drying might include", the last caption read : "mechanical ventilation of the stud space with dry air". One would think that when someone such as myself comes along (one year later, in 2000) to formally engineer a notion that CMHC has already contemplated, the implementation of same would be a cake walk. This was not to be the case. In fact quite the opposite occurred and so I started to suspect that behind it all, there lay a very big hidden agenda. This proved to be correct but it would take the better part of a year and a half to flush it out into the open.

Report No. 5, entitled: "Envelope Drying Rates Analysis", UBC/Forintek, 2001

This experiment was similar to the prior stucco clad wall experiment in 1999 and had the same objective which was to test the drying rate of code built walls. The author of this report (and project leader in charge of the associated testing program) was Mr. Don Hazleden. He is an architect by training and also, a former CMHC employee. The report is dated March, 2001 but it was floated as a "trial balloon" and presented by Mr. Hazleden at a British Columbia Building Envelope Consortium luncheon meeting in February which I attended. This is rather unusual because it is normally done the other way around. One usually publishes a report *prior* to presenting it so that the attendees can study it in advance which in turn enables them to ask informed questions. In any event and as it turned out, it did not matter. The trial balloon was burst during the question and answer period by Mr. Alan Toon, P. Eng., who happened to be my NRC advisor at the time. Mr. Toon's question was essentially this: "Well Mr. Hazleden, I see that you've got high moisture contents and mold growth at the bottom of most of these panels, so what's the point of all this ? If any part of the panel fails, we don't care what the

average moisture content is do we ?" Mr. Hazleden's response was: "I agree we have a problem there." Once again, the issue is acknowledged but remains unresolved.

Some eight months later, Hazleden's report was officially made public by CMHC who funded the experiment. CMHC's excuse for the delay was that it was "hung up in French translation" in Ottawa. When it finally did come out, the report confirmed what Mr. Toon had already exposed: that the panels did not dry out and that there was mold growth all over the shop. However, these conclusions were not clearly stated, you had to look for them. A case in point is the mold growth issue which was not even mentioned in the Summary, nor the Conclusions, nor the Recommendations. It was very conveniently tucked away in "Appendix 10" with no comments on the significance of mold growth, one way or the other.

There is one other very significant conclusion of this report which deserves our attention because I think it is a most fitting "end of the road" to the R&D portion of this whole boondoggle. It is from page V of the Summary and I quote:

> " However, the slow drying which occurred in other parts of the panels indicates that the designs as tested would not be effective at preventing decay by drying if allowed to be wetted to the test levels. These wall types have to rely on a more perfect deflection and drainage system as well as proper construction practices to avoid trapping moisture during construction." (underline mine).

Well folks, there you have it. Mr Hazleden takes the "super" cladding recommendation of the previous experiment to its logical conclusion; he now demands *perfect* cladding to make his airtight design work. This demand for perfection is nothing more than a last ditch attempt to find some way to rationalize an airtight design that is, quite simply, a colossal failure. It is a design that is simply not *conservative* enough – it's too *"risky"*. The remedy, as previously stated , is obvious.

Looking at all the previously described history, one could easily conclude that what we are witnessing here is more than a hidden agenda – it smacks of conspiracy. However that is debatable and for the lawyers to decide. In the meantime, there were more pressing matters to deal with. The time for study and talk was over. It was time to act.

Chapter IV

THE OWNERS ARE LEFT OUT IN THE RAIN

When I first contemplated the mechanics of my forced ventilation solution, the design automatically centered on the new construction application as opposed to the repair of existing buildings. All Engineers have a natural penchant for the *new* and the reason for this is quite simple: *new* means total control. However, in this particular case, it quickly became apparent that the "new" would have to wait because the "old" was literally hemorrhaging before our very eyes. It was estimated that approximately 100,000 units in the greater Vancouver area alone needed remediation of some sort and at an *average* cost of $25,000.00 per unit, this insidious little "problem" had grown into a $2.5 billion "monster" almost overnight. Something had to be done – now.

Bringing a new product to market is always difficult at the best of times but this particular market was so full of mistrust and misconceptions (on both sides), that the task became, as you will see, nothing short of gargantuan. The owners, who are also the victims, were down right angry and who could blame them. On the other side were the "authorities" who were, as we have seen, trying to keep as low a profile as possible and were sticking to their entrenched positions in hopes that no one would catch on and blow their cover.

In an ironic twist of fate, the victims had been brainwashed, mostly by a very gullible and uninformed media, into placing all of their trust into the hands of the only other "authority" left standing: the Province of B.C. Like most angry mobs, they demanded legislated "guaranteed protection" and they got their wish. The old saying: "be careful what you wish for…" is entirely appropriate. The net result was the Home Protection Act whereby the owners were legislated into a strongbox that even Houdini himself couldn't get out of.

I will deal with the details of this strongbox later but for the time being, it is sufficient to say that the owners didn't realize that they had made a Faustian bargain. They had traded away their freedom, in favor of government protection. They mistakenly assumed that when the government became directly involved, that there was an Engineer at the helm, as in every other aspect of the construction world. But the Engineer was not put in charge. He has been conspicuously missing in this industry since approximately 1760.This, in a very fundamental way, is one of the root causes of this whole boondoggle. More on that score later.

In light of all of the above, and after spending the better part of the next six months discussing and presenting my new approach to a large variety of owners (mostly in the form of Strata Councils), it became increasingly clear that some very serious roadblocks had been erected to effectively discourage *any* innovation from entering the market in a timely fashion.

The owner's anger was slowly turning to paranoia and the R&D part of this industry was still under the firm control of CMHC et al which, as we saw earlier, was a slow moving treadmill, by design. I concluded from this that the only practical way to crack open this strongbox was to use a two step approach. First, get a realistic (full scale) handle on the technical aspect: the true "quantum" of controlled interior air required to dry out a typical condo and also, a true picture of the extent of structural damage. With this information, I could fine tune and revise the system(s) as required. Secondly, meet face to face with the regulators to see if the appropriate changes or recommendations could be made to allow freedom of choice to return to the market.

The first step was relatively easy. My company performed a full scale trial of our newly designed *Building Wall Humidity Control System* on a few units of a small condo building in Vancouver. The results of the trial were very positive and as follows:

- A typical condo can be dried out in approximately 17 days.

- As a result of our *interior* approach, 100% of the critical structural components were exposed for all to see. The actual amount of structural damage encountered was, in relation to the overall size of the exterior wall surface, very small. Furthermore, these repairs could be easily performed from the *inside* and at very reasonable cost.

- The amount of repairs that will eventually be required to the exterior cladding varies considerably but one thing is certain – it is not (and never will be) zero.

As planned, we then proceeded to fine tune the design and publish the results of the trial on our website. Also, since it became increasingly clear that customers will almost always want "one stop shopping", we added a *Rainsteel Wall* design to our arsenal in order to deal with the exterior cladding repair issue on a worst case basis. It is essentially a structural steel reinforced strapping wall that provides an unobstructed drainage path and can be applied over top of any existing cladding. In this way it eliminates the need to rip apart anything on the outside of the building.

Now that the technical issues had essentially been resolved, it was now time to move onto the regulatory ones. I must admit I seriously underestimated how long this would take. Why the delay? Enter the provincial politicians.

Chapter V

POLITICS AND THE WARRANTY SCAM

The Home Protection Office (HPO), a creation of the Barrett Commission, is the provincial government's agency empowered to enforce the Home Protection Act. This act in turn stipulates who can and who cannot build or repair a residential building in British Columbia. Unfortunately, the way the Act is currently written, all of the final authority over who does what and when in this industry has been effectively transferred to a handful of private insurance companies posing as "independent" warranty providers. As I'm sure you can immediately conclude, this is potentially a very dicey proposition, not only from the point of view of cost but more importantly, from the point of view of control, especially the control of *risk to the insurer*. Let's face it, the best way for an insurance company to control risk is to suppress innovation and maintain the status quo.

On January 14, 2002, my insurance agent (Mr. Paul Towriss of Pat Anderson Agencies in Burnaby) and I met with HPO officials (Bob Mailing and Tom Reeves) at their Vancouver office to discuss the above described "problem". To make a long story short, they freely admitted that the warranty market was too restricted due to lack of "players" and so they were quite pleased to hear that Paul had some good contacts outside the existing small group of four companies who had effectively cornered this market. These outsiders had expressed an interest in our approach to the problem and were interested in "getting on board" as it were.. I should also mention that, right from the start, Paul and I had made it crystal clear to them that we were not interested in the status quo. We were going to enter this market by immediately raising the standards bar to the necessary level for *buildings*: a 70 year performance based warranty.

At first the HPO officials were taken aback by the boldness of this proposal but as they became more familiar with precisely how we intended to *engineer* it, they seemed to be starting to appreciate that this higher standard was not as difficult a climb as it might first appear. In any event, they did not disapprove of it and so they wished us luck and off we went.

During the next 8 months, Mr. Towriss and I were to test the world wide warranty market and with only one exception, every company we spoke with was initially very positive and then, suddenly, clammed right up. When they refused to even price out the 70 year warranty option and gave no rational explanation as to why, the whole shady business was exposed for all to see. In order to understand it, one has to go back and look at how this whole warranty business began and who was responsible for it.

Right from the outset, the HPO were forced to go to the private insurance market for warranty providers because of the collapse of the only other act in town: New Home Warranty. Terms for these warranty policies were created "in consultation with the industry". Translation: dictated to by the insurance industry on a strict take it or leave it basis. The only choice for the government was to step up and underwrite it themselves, which of course, was a non-starter. This is essentially how the HPO ended up being a front for the warranty companies and have inadvertently created a license to steal. Here is how it works.

The HPO "approves" of the contractor, if and only if the contractor is "approved" by the warranty companies. In order to qualify, the contractor must *indemnify* the warranty companies against any claims that the warranty companies may have to pay out ! How's that for a deal ! The warranty company collects enormous premiums (roughly 5 times the normal bonding rates) but takes very little risk, if any. Not only that, they literally walk away after 5 years ! This last part is the most unbelievable aspect of the whole fiasco. Heck, even a Dodge has a 7 year warranty! Some HPO officials will tell you that the reason for the short 5 year term is because it is expected that most defects will occur within that time. This, of course, is nonsense.

The large cracks that I uncovered in the old 1925 buildings in New Westminster, did not occur in year 5 but more likely, in year 35. The fact of the matter is, it should not (and it does not) matter when they occur if you design accordingly. This is precisely what our forefathers did from 1760 to 1975 - *by default*. I will have more to say about how to properly handle this aspect in the next chapter.

As stated earlier, there was only one exception to the response we received from the warranty companies and as it turned out, it was from one of the biggest players of them all – Lloyds of London. They approved of our warranty proposal and said so in writing. They were even prepared to live with the current market pricing but unfortunately, September 11th, 2001 changed all that. This last disaster had effectively pulled the rug from under the world wide insurance market to the tune of several billion dollars. The following email sent to me May 22nd, 2002 by the Lloyds of London agent, Mr. Wayne Davidson (of D&L Underwriting in North Vancouver), explained their position as follows:

Ken:
Regrettably, we are unable to place your warranty program.
We have spent much time and effort in trying to place this warranty program including our discussions in London in March with various syndicates to see if we could get interest.
Recently we have had discussions with Elite Insurance Company but our efforts were to no avail. In all fairness to Elite our submission at least got to their Toronto office where they conducted a review of the program.
We would not have got involved in this warranty program based on your patents if we did not think that there was merit from an underwriting perspective in your design and application. As you know, our experience in warranty programs goes back to 1974 and we have been involved in a variety of warranty programs in Canada and the U.S.
I think the current insurance difficulty is diminished capacity in the world wide insurance market largely as a result of 9/ 11. With rapidly increasing premiums insurers are more selective where they attach their capacities and in particular new accounts with more sophisticated covers are having difficulties being place at all.
We still think your design and application for your Rainsteel Wall and Building Wall Humidity Control System should be insurable under a warranty program pursuant to the Homeowner Protection Act / Building Envelope Renovation Regulations.
However in this current market we can bring the insurance horses to water but they are not thirsty.
Yours very truly,
Wayne Davidson.

Although the above would force us to put the third party warranty campaign on the back burner for the time being, it did tell us something else which I think was equally important. It confirmed the fact that there was nothing inherently "risky" with our whole approach and that Lloyds would have in all likelihood stepped up to provide the warranty it if it were not for the fact that some vile terrorists had "thrown a wrench into the gear box" so to speak. Furthermore, it is not intuitively obvious that what we are dealing with here is a highly unusual circumstance until you try and answer the following question: Name one product in the modern world where the government requires that the producer of a *new* product provide a *third party* warranty *prior* to the product being introduced to the market place ? Of course there is no such thing in modern times and in that sense what we have accomplished here with Lloyds is really quite a feather in our cap. Also, it is rather fitting that it has happened with Lloyds because as I recall, the last time this kind of process was actually used was when the great clipper ships of the 18th and 19th centuries were "certified at Lloyds of London" prior to plying their trade on the oceans of the world. What a great success that turned out to be for all concerned and looking ahead, I see no reason why the same thing cannot happen here when the tide changes in the not too distant future.

However, in a more general sense, what we are witnessing here is an insurance "roadblock" and this occurs in industry quite regularly when insurance rates get out of hand, for whatever reason. The remedy is self-insurance which is a very common tool used by industrial corporations when insuring such things as equipment and/or a

fleet of vehicles in these types of situations. Applying the same principles to buildings, Mr. Towriss and I created the Condominium Owners Warranty and Capital Recovery Fund. In essence this program enables individual Strata's to take charge of there own warranty affairs by paying premiums into a strictly controlled trust fund. The term follows our standard 70 year warranty format and using normal contribution rates, the fund is self-financing at an 8% rate of return. In other words, at 8%, the compound interest is sufficient to pay the administration fees and anticipated repairs. This means that the principal is 100% refundable to the owners in each 10 year term and thus the true net cost of the "warranty" is zero.

This concept was introduced in June 2002 and was very well received except by, you guessed it, the HPO. They would not permit it because according to their regulations, all warranty providers must be "approved" by the Financial Institutions Commission and as I am sure you've already deduced, this next layer of bureaucracy only "approves" of big insurance companies. Therefore, the net result is that because of this HPO regulation, strata unit holders are not allowed to self insure. In essence they have fewer rights than industrial corporations by virtue of the fact that they happen to own units in a building as opposed to a fleet of bulldozers. This is a good example of how over-regulated we really are and whose true interest is really being served by this type of "motherhood" regulation.

In the meantime, while all of this was going on, the government of the day changed in Victoria. At first it seemed like the winds of change would finally force the HMS Leaky Condo to come about and make up for lost time on a new and more productive tack. Unfortunately, this was not the case. After numerous letters, emails and faxes bringing them up to speed on the technical aspects, the warranty scam, etc., it quickly became apparent that either the government did not know what to do or that they chose to do nothing. I think that it was the latter. The technology involved is not that complicated and it does not take a genius to figure out that if an airtight standard is indeed largely responsible for this construction disaster, then they and the federal government are most certainly 100% responsible for the consequences of same. It is after all, *their* building code. This is why, after all the initial grandstanding in the press about how they were going to solve the problem once and for all, they have accomplished absolutely nothing in practical terms.

Of all the people we spoke to or corresponded with, including Premier Campbell, Minister Abbott, MLA Jarvis and Minister Christie Clark, MLA Dan Jarvis appeared to be the most concerned with this issue. Mr. Jarvis was appointed chairman of the Leaky Condo Taskforce in September 2001. Mr. Spratt and I met with Mr. Jarvis at his constituency office on October 25th, 2001. The next day, Mr. Jarvis sent me a 10 page fax containing the now familiar standard excerpts from the Barrett Commission and other sources. Mr. Jarvis requested that I provide him with a critique of this material and suggested that I do it "anonymously" . I responded in full to his fax on October 29th, 2001 and told him that I was not worried about anonymity because "as far as I am concerned, the sooner the whole issue is flushed out into the open, the better it will be for all concerned."

On November 14th, 2001 I appeared before the Leaky Condo Taskforce Committee to provide them with my views on this whole matter and to answer questions. To make a long story short, the Committee was made aware in plain terms of the whole history of this issue from 1760 right through to the current warranty scam. However, something else happened during the meeting which I found most revealing. Like most lay people, the Committee members are effectively non-technical and in itself, this is not a bad thing. In fact, under the circumstances I think it is a very good thing. It forces a dialogue between producers and consumers which is needed. This arrangement also has another benefit which although unintentional, is nonetheless, extremely useful. The questions asked by Committee members usually reveal some deep rooted notions that through endless (or mindless) repetition over a long period of time, have become the accepted bromides of today. In this particular case, the most revealing question was this: "But Mr. Dextras, what about the condensation problem? Isn't that why we have a vapor barrier ?" Here is how I responded to this question:

" So you think we have a condensation problem? Where do you get that notion? Before you go looking for a government authority to provide you with what you assume is an unbiased explanation, let me save you the trouble. Stand back for a moment and start thinking about the problem as an experienced engineer would, not a grade 12 science teacher. What is the overall "quantum" of condensation involved *year to year* (not minute to minute) and is it relevant ? You don't have to do a lot of fancy calculations to arrive at the proper conclusion. Imagine for a moment two buildings: one building built in 1925 and the other, say in 1995. Regardless of the different exterior wall types, the interior conditions of the air are essentially the same. The people who rent a unit in the1925 building generate more or less the same amount of internal moisture (in the form of vapor from cooking, washing, etc.) as the people who own the unit in the 1995 building. And yet we now know conclusively that this same warm and vapor laden air is escaping literally unimpeded right through the 1925 building wall and so, when the ambient air temperature on the outside is sufficiently cold, some condensation must be occurring in this 1925 cavity. Before you go trying to account for every drop, just look at the historical record and your problem is solved. Whatever the net quantum is moment to moment, it doesn't amount to a hill of beans because the building has lasted over 75 years and is doing very well. The obvious conclusion one can now draw from this is: it is not cold enough, long enough (in this temperate climate) to make any difference whatsoever and so if any government authority has told you that you must have a vapor barrier to control your "condensation" problem , he's blowing smoke. In fact upon further reflection, I have concluded that he's blowing smoke in all of Canada and here's why.

I happened to have been born and raised in the Ottawa Valley where it is "cold enough, long enough" and looking back on the un-insulated and un-sealed buildings that I lived in during the 1950's and '60's , I now realize that I was witnessing this "condensation" almost every winter's day but didn't know it at the time. A case in point that comes to mind would have been a very typical scene in my grandmother's kitchen . She would be cooking over a stove and doing laundry in the same room using and old-fashioned ringer washing machine which connected to the faucet on the sink. Here's the situation. The air in the room is so thick with vapor, you can almost cut it with a knife. And the air outside is not minus 5 degrees Celsius like it is in Vancouver, it is minus 25 degrees Celsius ! Is there condensation going on in those exterior walls ? Of course there is, but is it relevant ? No, because as my father recently reminded me, my grandfather's house was torn down just a few years ago. Hence, again, whatever the net quantum of condensation is, even in this severe condition, it's all beside the point because my grandfather's building lasted almost one hundred years. The technical reason for this is again fairly obvious. The high vapor "event" is very short lived relative to the rest of the day and once concluded, the heating system takes over and brings the whole building, stud cavity and all, under "dry control". Think of it this way: day in and day out, the "condensation" event lasts for say, two hours at best, but the "drying" event lasts for 22 hours. This is why this so-called problem is not a problem at all for anyone, except of course, for politicians with a hidden agenda. This is what we need to deal with next.

One might rightfully ask: how on earth did the government ever rationalize this air-tightness issue in the face of millions upon millions of obviously successful buildings right in their own backyard, the heartland of the country, Ontario and Quebec ? As we have seen before, the heat conservation benefit is the prime mover of their agenda but there's something else involved. Even in a relatively free country such as Canada, it is still difficult for the government to ram their version of the economic good life (ie, saving on heat) down the throats of ordinary citizens. It is much easier for them to do so under the veil of a safety issue or adequate structural performance. What is needed is a technical "hook" and the code authorities found this hook in the condensation problems that were encountered in a few isolated cases in Northern Ontario. In these extreme cases, the condensation problem was an issue not because of the severity of the exterior conditions, but because the *interior* space was so poorly ventilated. The occupants, in a desperate attempt to save on heat (!), had plugged every possible air escape hole. The net result was to create a continuously damp interior environment. In essence, they were living in the equivalent of a sauna.

Well folks, the fact of the matter is, 99.99% of us don't live in a sauna and so this condensation issue is irrelevant to the vast majority of Canadians. Also, I don't think we should be modifying building standards in any way shape or form to satisfy the needs of such a small minority. Unfortunately, through a combination of duplicity and slight of hand on the part of our government, and complacency and blind trust on our part as citizens, I think we have accomplished exactly that. In this context, people often ask me whether we need a vapor barrier anywhere in Canada and my reply is simply this: It's not a bad idea as long as you *complete the design* and provide adequate ventilation. Bottom line: it's ok to want to save on heat, but don't go overboard – don't be *penny wise and pound foolish* . In the final analysis, this is where all of our highly paid code authorities went wrong."

As discussed earlier, what the government has effectively done about this whole debacle can be summarized in one word: nothing. The long awaited report on the findings of the Leaky Condo Task Force was never published. I think the reason for that is obvious – they did not get the answer they wanted to hear. They did not want to be reminded that their blind acceptance of the federal building code was, in the final analysis, the match that lit the fuse almost thirty years ago.

WILL SOMEONE PLEASE CALL THE ENGINEER

Despite all the preceding discussion, it is still hard for most ordinary citizens to accept that such a simple thing could cause such havoc in our modern technological world. This malaise is the common thread that links all of the strata owners whom I have spoken with during the past three years. This in turn has led to the creation of an enormous wall of skepticism and mistrust. It is easy to assume that this foul mood is simply caused by the fact that these owners have been very seriously hurt (or, more appropriately perhaps, blindsided) by this disaster but that's not quite the whole story. In my view, these people sense that beneath all the politics and the technical mumbo jumbo, there lies a much more fundamental flaw in the system that is at the root of it all but they just can't put their finger on it. This flaw can be identified by again looking at the problem through the lens of historical perspective but this time, the context is how it fits in the "engineered" world we live in. As it turns out, this flaw is manifested in a very basic misconception in the public mind and as you will see later, the resolution of this will lead us to a very practical and permanent solution to the whole issue.

This misconception is primarily manifested in the notion that the public has nothing to worry about because a Professional Architect has "designed" the building. The Architect "designs" the interior and exterior space (arrangement of rooms, how the building looks and fits on the lot etc..) but he is not, strictly speaking, supposed to be involved in the "design" of the details that make the building "work". In high rise buildings (which are necessarily steel or concrete framed), this traditional delineation of responsibility is clear cut. Although the Architect and the Engineer work closely together (for obvious reasons), there is no doubt that all the physical details of the high rise building envelope are "designed" by the Engineer. He's in firm control. He "makes it work". It is also important to note here that the Engineer's design is primarily driven by mathematical *analysis*, not blind adherence to the applicable building code. In this case the applicable code is the steel and/or concrete code and it is of secondary importance only. It is used at the end of the analysis to check the resulting design against a set of practical "rules of thumb". In essence then, for these materials, the analysis drives the design and the applicable "code" is its subservient handmaiden.

In low rise wood framed buildings however, this fundamental "separation of powers" between the Architect and the Engineer does not exist – *at all.* The reason it doesn't exist is because the Engineer is not even in the picture. He's not needed because the design of a wood framed building envelope does not require *any* mathematical analysis whatsoever. The design (if you can call it that) can be done by simply following the "recipe book" – the wood frame portion of the building code. Like any other recipe book, it is so completely prescriptive that almost anyone can piece it together. It should come as no surprise then, that the actual person who has been doing the "design" of the wood framed building envelope is: the Architect's draftsman. And before you go pointing fingers at this poor chap, think again. He is only doing what he's been *forced* to do by a code authority that has written into law a recipe book that completely ties his hands.

It may interest you to know that the above described fundamental flaw has been with us ever since "wood frame" was added to the general building code in 1965 and continues to this day. In itself, this empirical building code approach to design is not necessarily a bad thing, as long as you just keep doing *exactly* what you did before. If for any reason *change is contemplated*, as it was in 1975 and certainly in 1985, then it would be wise for society to insist that the ball be turned over not to the government bureaucracy who initiates the change, but to the Engineers who have been left out of the loop and who know how to "make it work". Unfortunately, and to the surprise of many owners, this has not been the case in the past but it is precisely what we need to do now.

In general terms, there are two prime contributors to the long term success of major civil engineering works: conservative design and full inspection by a *Resident Engineer*. For those of you who are unfamiliar with the term, conservative design is a design which has long term durability built into it. The Scots have a good word for it – they call it "skookum". It's tough, durable, strong and can take just about anything nature can throw at it. On the inspection side, a Resident Engineering service is precisely what the term implies : the Engineer "takes up residence" (so to speak) on the site. He inspects *everything* and if this requires working around the clock because the contractor is in a hurry and working 24/7, well, so be it. No stone is left unturned and nothing is left to chance.

The immediate reaction of most people who hear this for the first time is: Oh, yes but this approach is very expensive isn't it ? Again, this is a huge misconception and in reality, precisely the opposite is true. For example, in major public works, the *total* engineering fee, including the resident engineering service, is usually under 6% of the value of the work. Furthermore and in the particular case of the building envelope, I estimate that the cost of both conservative design (ie; upgrading the current design by adding forced ventilation) and full inspection by a Resident Engineer will add somewhere in the order of 5 to 8% to the cost of the work. One final point on the issue of cost which needs mentioning, is the issue of warranty. Most people are shocked to learn that the "warranty" provided on major civil engineering works is not 5 years or 10 years or 70 years, it is *one* year and the cost is incredibly reasonable (less that 1%). It is not even called a warranty; it is called a maintenance bond. What this tells us is that when you design conservatively and inspect the heck out of it, you don't need a warranty, *at all*. How appropriate.

Finally we come to the question of how to incorporate the above tried and true engineering principles into the bureaucracy that controls this industry. On the conservative design issue, let us not fall into the same trap that our code authorities now find themselves in by being overly prescriptive. What is needed here is a performance standard. What we want to do is tell the Engineer the end result we desire without telling him specifically how to get there. In short, tell the man what you want but don't tell him how to do his job. I think this can be accomplished by using what I call a "Building Envelope Certification Letter". Here is a sample of one that I sent to the Premier's office for consideration on August 6, 2002 :

BUILDING ENVELOPE CERTIFICATION LETTER

Government of British Columbia
c/o Ministry of Housing
Victoria, B.C.

Attention: Minister of Housing

RE: Exterior Building Wall Construction at _____

Dear Sir:

This is to confirm that if the above work is executed and maintained in strict accordance with the attached plans and specifications, then, in my professional opinion, this installation will successfully resist the anticipated design loads and thereby fulfill its intended structural purpose for a period in excess of 50 years.

Yours truly,
Jack Doe, P. Eng.

The above will automatically give us the desired end result. It allows sufficient flexibility for the Engineer to design according to the particular circumstances of his client (and possibly offer him some alternatives) but in all cases, the design must meet the necessary "conservative" standard of 50 years plus. What this also does is put the code or "recipe book" where it belongs – at the back of the bus, not in the driver's seat. Furthermore, this approach can also completely eliminate a huge bureaucracy (HPO et al) and replace it with one person collecting certification letters prior to issuing permits and/or loans. The only additional limitation that I think should be imposed is that "Jack Doe" be a Registered Professional (Civil) Engineer licensed to practice in B.C. who has at least 20 years experience under his belt.

On the full inspection issue, this can be easily accomplished by simply asking the Municipalities to modify their existing *Letters of Assurance* requirements governing site inspections. It should also be mentioned here that amalgamating all inspections under the Resident Engineer may actually provide a net saving to the current practice, which is an overlapping hodge podge of random inspections performed by individual disciplines.

In light of all of the above, one can rightfully ask whether the buying public will be willing to pay a 5 to 8% premium to get the long term performance that they require. Well folks, I think that question is best put to the 100,000 or so owners who have been, or are in the process of being, burned to the tune of $2.5 billion. I think the proper perspective on the whole financial side of this issue can best be summarized by quoting an old adage that comes to us from the medical profession: "an ounce of prevention…, is worth a pound of cure."

AFTERWORD

As shown on the first page of this book, the Leaky Condo Boondoggle ranks as a very close second to the largest construction disaster in world history: Chernobyl. Also, it is rather ironic that both of these disasters are not only in a financial class all to themselves, but they share another dubious distinction that separates them from the rest of the crowd – they are both a direct result of bureaucratic ineptitude over a long period of time.

This may come as a surprise to some of you who thought that Chernobyl was simply a one-off accident but nothing could be further from the truth. I once worked in Nuclear Power (for Ontario Hydro) and so I can tell you that it was a well known fact within the engineering and scientific community at the time, that Chernobyl was simply the culmination of a long series of "meltdowns" that had been going on behind the iron curtain for more than 30 years prior to this failure. Therefore, the real reason for the Chernobyl disaster was this: a *non-conservative* design, managed and controlled by an all powerful government agency that was, for all intents and purposes, unaccountable to anyone and, very good at covering its tracks. Sounds awfully familiar doesn't it.

The solution, as in most things of this nature, is: freedom with personal accountability. Is this absolutely foolproof ? No, of course not but looking at all the achievements of the western world, I think it has served us very well. Also, no one on this planet of ours is omnipotent and so there will always be singular errors in judgment such as Galloping Gertie or the Vaiont Dam. But as history also tells us, we are resilient enough to overcome this kind of failure. We can, as old Professor Osler used to say: "pull ourselves up by our own bootstraps and press on". Systemic failure however, is a totally different kettle of fish because as we have seen, it is an extremely difficult thing to uncover let alone make it "come about". As a result of this and since the consequences of systemic failure are an order of magnitude higher than anything else, we have to be very diligent in guarding against it.

Another important lesson that we must learn from this leaky condo disaster is how we reacted to it when it first reared its ugly head. There is a knee-jerk tendency on the part of our politicians to not only simply throw money at the problem, but also, to add more bureaucracy. Since in this particular disaster the bureaucracy was at the root of the problem to begin with, then what our politicians of the day in effect did was to make matters worse. They were literally "adding fuel to the fire". Innovation is the key to solving any problem and excessive regulation is nothing short of an innovation killer. It also lulls the public into a false sense of security. What we have uncovered here makes it abundantly clear that for the public to trade away its freedom of choice for the apparent warmth and comfort of "motherhood" type regulations, is a mistake. What is needed to get the best ideas to market in the shortest possible time is to: set them free.

Finally, I would like to try and convey to you what I think is the most important lesson of all that we need to learn from this colossal disaster. We have to stop and think about the true value of conservative design in everything we build. We have to stop playing it short range. We have to remind ourselves, that at the heart of all our great civil engineering achievements (the Brooklyn Bridge, the Hoover Dam and yes even our own Pattullo Bridge), there lies a series of singular conservative thoughts, decisions, actions. It is the conservatism of these thoughts that gives these achievements that "rock of Gibraltar" quality and enables them to stand the test of time. Can we afford to apply this tried and true conservative design philosophy to our homes as well as our great public works? Of course we can. It's not that hard a climb and besides, can we afford not to? Can we afford to keep taking "*risks*"? I don't think so, but that is not my decision – it's yours.

Kenneth G. Dextras, P. Eng.
New Westminster, B.C.

APPENDIX I

THE ST. JAMES (1927) – 5th St. and 4th Ave. – New Westminster

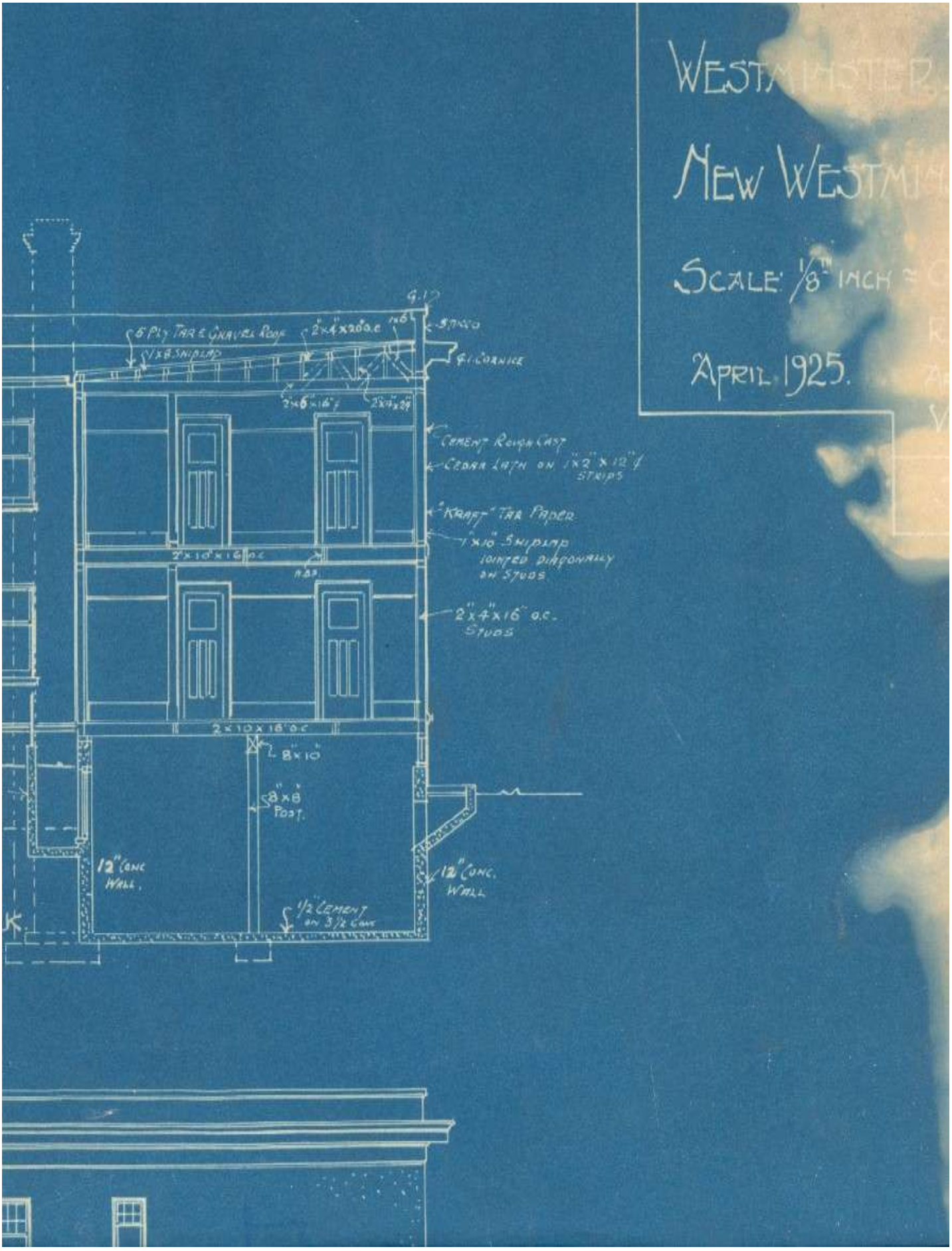
THE CARLTON (1925) – 4th St. and 3rd Ave. – New Westminster

WESTMINSTER APARTMENTS (1925) – 2nd St. and 3rd Ave. New Westminster

THE ST. JAMES (1927) – EAST FACE

THE CARLTON (1925) – 3rd Ave. New Westminster – Northwest Face

Cladding Details and Materials


WESTMINSTER
NEW WESTMIN
SCALE: 1/8" INCH
APRIL 1925.
5 Ply Tar & Gravel Roof
1"x8" Shiplap
2"x4"x20 o.c
1"x6"
Stucco
Gl. Cornice
2"x6"x16"
2"x7"x24"
Cement Rough Cast
Cedar Lath on 1"x2"x12" Strips
"Kraft" Tar Paper
1"x10" Shiplap jointed diagonally on Studs
2"x10"x16" o.c
2"x4"x16" o.c. Studs
2"x10"x16" o.c
8"x10"
8"x8" Post
12" Conc. Wall
12" Conc. Wall
1/2" Cement on 3/12 Conc

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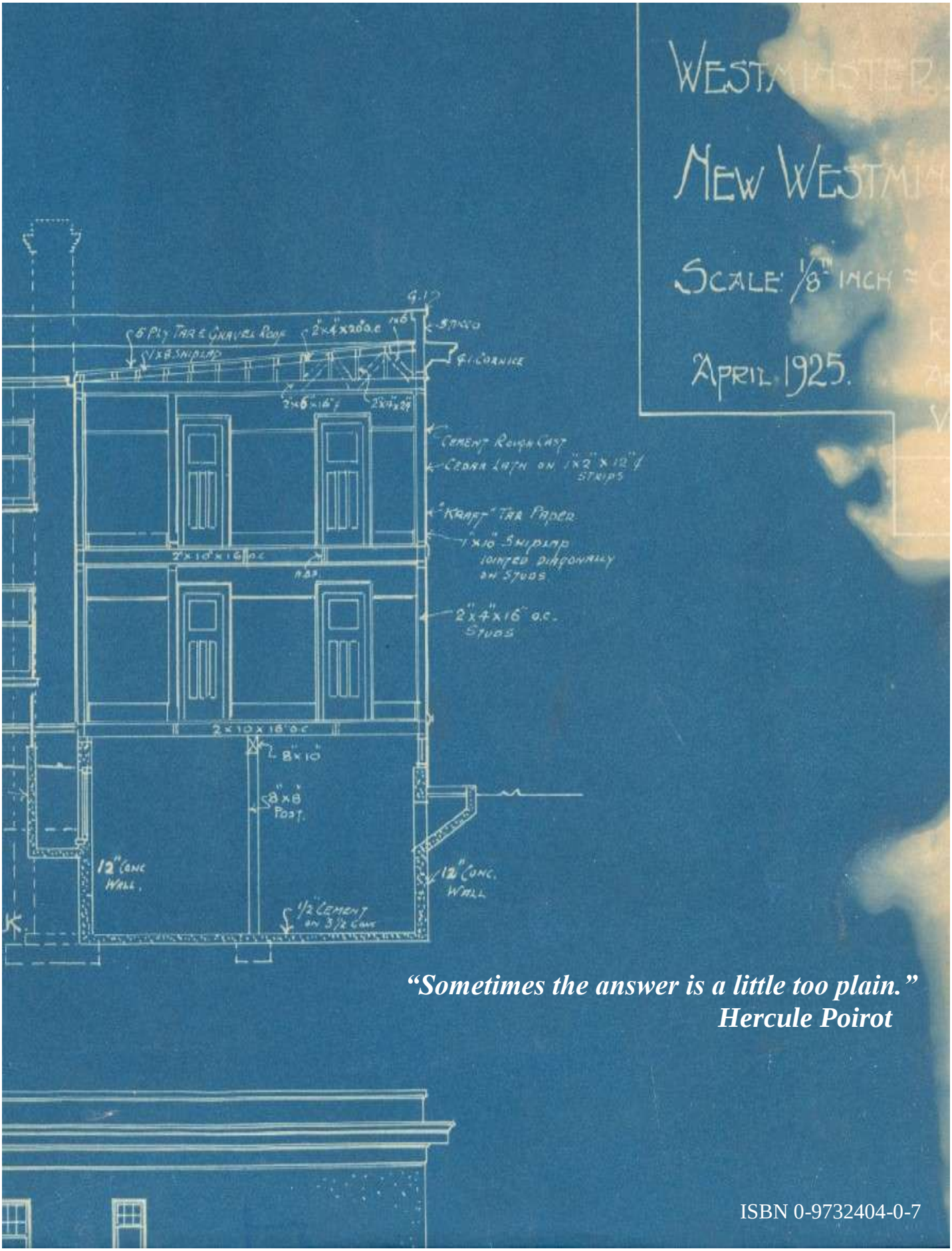

"Sometimes the answer is a little too plain."
Hercule Poirot

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