

# **SURVIVORS IN THE MIDST OF DEVASTATION, Traditional Timber and Masonry Construction in Seismic Areas**

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## **ABSTRACT**

In this paper, I will explore a different set of questions about earthquakes than those usually asked by engineers. Rather than dealing with the methodologies for strengthening masonry and timber structures, I will examine the key aspects of historical construction that have allowed many of the older and seemingly weak buildings to survive strong earthquakes, even where newer buildings made of reinforced concrete collapsed. The objective of this study is to contribute to an understanding of historical vernacular buildings as sources of knowledge about structures and construction, and not just as windows onto a cultural or architectural history perspective.

## **Introduction**

Because earthquake forces can be overwhelming to pre-modern construction, and to unreinforced masonry in particular, an examination of the relative performance of buildings constructed using differing systems in various areas of the world can provide important insights into the performance of materials that cannot be understood from an examination limited to modern materials and practices alone. This analysis not only can assist in the conservation of surviving examples of pre-modern construction, but it also has the potential for stimulating ideas that may be relevant to new building construction in seismic areas – particularly in areas where the local culture, economy, or structure of the building delivery precludes consistently safe construction of buildings using modern industrialized materials – particularly reinforced concrete.

## **Background**

Two developments have occurred over the last 75 years of engineering and construction that have affected our understanding of the behavior of traditional construction. First, engineering instruction has come to rely on a mathematical construct for engineering design – with mathematical models which become extremely complex if used to measure damage and loss of capacity in systems that are constructed with composites of brittle materials, such as masonry units set in mortar beds. Second, the empirical understanding and acceptance of the characteristic behavior of masonry under different loads has, for the most part, disappeared as architects, engineers, and builders have shifted their attention to more modern materials and systems.



ABOVE & RIGHT: Himis house constructed by the father of these brothers in 1945. It survived the earthquake with only cosmetic damage.



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Without doubt, many masonry buildings in history have collapsed on their occupants in earthquakes. However, not all have proven to be equally vulnerable, and some have even survived unscathed next to modern buildings that have collapsed. It is those that have defied today's conventional wisdom by surviving a large magnitude earthquake that are the most worthy of study. Such examples can be found among the seemingly unpretentious, weak, insubstantial, but common buildings that have been maintained and renewed for generations. In Turkey and Kashmir, India, for example, these survivors are constructed of masonry and timber – rubble, mud, and lightweight pieces of wood – often without stucco or fancy finishes. Variations on this construction typology can be found to exist across the broad seismically active belt that extends around the globe from Africa and Europe across Asia to Central America.

Masonry buildings can resist the effects of large earthquakes through the effects of a number of different mechanisms. Many monumental buildings representing the greatest of investments by their builders with an eye towards longevity have done well because of elaborate construction or the introduction of iron ties, as was done by the ancient Greeks in the Parthenon. But what about more common buildings – buildings constructed by ordinary people to provide places to live and to work? These structures rarely have access to the kinds of technology used by the ancient Greeks or the sheer mass of material that, for example, protected the Mexico City Cathedral. The circumstances that lead to the survival of these particular buildings appear to be either luck, or born out of technologies developed as much for their economy as for their strength. It is in this context that this paper examines the particular form of masonry construction that can be found in different variations in many regions around the globe – masonry with timber lacing in the walls.

Timber laced masonry can be broadly divided into two subcategories – timber frame with infill masonry (infill-frame), and bearing-wall masonry with horizontal timber lacing (laced bearing-wall). Variations on these two types can be found sometimes in the same building, as has been observed, for example, in Turkey, Greece, Macedonia, Kashmir, India, and Ahmedabad, India. The first area to be discussed will be Turkey – where two devastating earthquakes in 1999 were followed by a smaller one in June 2000 – each of which affected traditional structures as well as modern reinforced concrete buildings.



Hıngı construction with stone infill, Safranbolu, Turkey

### **The Ottoman style of construction in Turkey**

Turkish traditional construction mostly falls into the infill-frame category. This type is most well known in the English-speaking world from its medieval and Elizabethan roots in England as “half-timbered.” It can be found in Europe and the Middle East in earthquake and non-earthquake areas alike. Unlike in England and other parts of Europe, however, this form of construction has continued to be used in Turkey almost until the present, and its comparatively good performance in the earthquakes that periodically affected a large part of the Anatolian peninsula may have contributed to its continuity of use.

Timber with brick infill vernacular construction is documented to have originated in Turkey as early as the 8<sup>th</sup> Century AD (Günay, 1998, p32). One hypothesis is that the building tradition traveled from Europe into Asia as a result of the reach and influence of the Ottoman Empire, which at one time extended almost from Vienna to the Caspian Sea. Observing where this method did not become a predominant building type supports this hypothesis. For example, this type of construction is not found in Kathmandu,

Nepal, and is extremely rare in the area of western Gujarat, which was recently devastated by the Bhuj Earthquake. These differences may have resulted from the fact that the Himalayan Mountain-protected Kingdom of Nepal never has lost its independence, which kept it isolated from the cultural influence of the Ottoman Empire, and Western Gujarat remained a largely Hindu region of princely kingdoms. Even though the Mogul-controlled city of Ahmedabad was in close proximity, the Moguls had less influence on Western Gujarat than on other parts of the Indian subcontinent.

In Turkey, the Ottoman style house with its tiled roof, extended timber and brick bays, all surmounting a heavy stone bearing wall base, has become an icon known worldwide. Genuine Turkish traditional architecture is intertwined with the traditional way of building. The overhanging jetties actually serve to strengthen the buildings because the joists, which extend well beyond the walls below, hold those lower story walls firmly in place with the weight of the overburden from the overhanging upper story. This compressive force gives the walls below added strength against lateral forces. The upper story, which is almost always constructed with a timber frame infilled with a single-wythe of masonry, is lighter than the bearing wall below, but reinforced against lateral forces by its frame.



"Hınıs" house with stone infill with mud and lime mortar, Saffronbolu

In the many houses that have the first story of stone bearing walls, the stone is often laced with horizontal timbers, (In Turkish: "*hatıl (s) hatıllar (pl)*"). Frequently these timber reinforcements consist of very thin timber boards laid into the wall like a course of masonry, at vertical intervals of about 3 feet (1m). They are placed so as to overlap at the corners. They thus serve to bind the stone layers together without interrupting the continuity of the masonry construction.



Detail of stone 1st story of house showing "*hatıllar*" imbedded in wall, lapping at the corners.

On the upper floors (or all floors in many buildings) the timber frame and masonry infill style of construction ("*hınıs*") is most prevalent. By not continuing the heavy multi-wythe bearing wall masonry up to the roof, but instead substituting the infill-frame, the walls are much lighter and thus capable of being supported on cantilevered joists and brackets. The architectural effect of this in Turkey is the appealing view of the characteristically Turkish jetties that overhang the streets, which, where they survive, give so much visual vitality to historic Turkish towns.

### The Kocaeli Earthquake of August 17, 2000, and the Düzce Earthquake of November 12, 2000



Surviving "*hınıs*" house next to collapsed row of reinforced concrete buildings, Adapazarı

The Kocaeli Earthquake caused the death of approximately 30,000 people (Kandilli, 2000). The epicenter was just 200 km east of Istanbul. In some areas of the affected cities of Gölcük and Adapazarı, the earthquake destroyed more than a third of all housing units (Kandilli, 2000). When the news of this earthquake spread around the globe, it was not immediately clear whether there were examples of the traditional construction described above within the damage district, but

because of the prevalence of this type in Turkey overall, it seemed likely that some could be found. If such examples could be found, then this earthquake would provide an important opportunity to study the effects of a large earthquake on these buildings.

In order to examine the performance of the traditional *hımsı* construction, one had to go to the area. The impacts on historic masonry buildings simply were not on the radar of most of the engineers who surveyed the damage from the earthquake. As it turned out, there were clusters of *hımsı* buildings in the heart of the damage district in both Gölcük and Adapazari. In Gölcük, in an area near a series of apartment complexes where every single building had been reduced in height by one story because of collapsed columns was a cluster of older brick and timber, or *hımsı*, buildings. These houses were not of great age, mostly dating from the early part of the twentieth century, but they all pre-dated the ruined reinforced concrete apartment blocks nearby. In this same area, within 100 meters of the *hımsı* houses, a surface trace of the fault was visible. At this location, the land had dropped 2.5 meters, dragging some buildings and with their sleeping occupants under the sea. Some of the nearby *hımsı* houses, standing next to collapsed apartment buildings, were damaged, but many of these seemingly crude and weak vernacular buildings had survived nearly unscathed,



Undamaged, 3 story "Hımsı" style in heart of damage district, Gölcük

It was a scene that was repeated in Adapazari. There, because of the softer soils, many modern buildings either collapsed or sank into the ground, ending up at cockeyed angles. Many of the older houses remained intact, but a few that were surveyed were heavily damaged. In the case of the one collapsed house, which was a rare instance of a death caused by the collapse of a traditional construction house, there was little to be learned from the indefinable ruins. It was the partially damaged buildings here, and also in Gölcük, that provided evidence of how this type of construction responded to earthquake forces.

As each building was inspected and the damaged area in each building identified, a pattern began to emerge. Some were damaged because later alterations had severed the timber frames. In a significant number of cases, the damage was concentrated at areas of rotted timbers. Interviews with nearby residents often revealed that those with the most timber decay had been unoccupied for years prior to the earthquake. Thus, it was evident from the damage that decay of the timber armature in infill-frame structures significantly degrades their performance in earthquakes. This range of damage was instructive, as it showed that the houses had not escaped the effects of the earthquake because of some local geological anomaly (the nearby collapse of modern buildings also appeared to counter that possibility). It also enabled one to study the progression of damage to this type of construction, and thus to understand how the traditional construction responded to large scale earthquake shaking.



Damaged "Hımsı" house in Düzce showing intact infill wall under plaster shed by the "working" of the wall

The reconnaissance of the damage district included the examination of the interiors of some houses that outwardly appeared to be undamaged. This more detailed survey resulted in the following observations: (1) It was evident that the masonry infill walls responded to the stress of the earthquake by "working" along the joints between the infilling and the timber frame. This was manifested as cracks in the interior plaster along the walls and at the corners of the rooms. This level of damage was evident in every house examined on the

interior. (2) In those cases where the damage was more extensive, small sections of the infilling had fallen out from between the studs near the top of the upper story walls.

(3) In those few observed cases where the damage had compromised the timber frame, this damage was usually manifested as separation of vertical timbers from the sill plate at the base of the structure. (4) Shear 'X' cracks within the masonry panels where the masonry units (in this case always fired bricks) were not observed in any of the examples. (5) The subdivision of each structural bay with a tight network of vertical, horizontal, and diagonal timbers, rather than vertical studs alone, appeared to have been successful in reducing the possibility of the masonry falling out of the frames because of the crushing or shear cracking of the individual panels.

### **Strength versus capacity**

The basic principle in weak frame and infill construction is that there are no strong and stiff elements to attract the full force of the earthquake. Strength can be used to describe the vertical load carrying capacity of the traditional structures, but these structures do not have much lateral strength – at least not within the elastic range. What those that have survived earthquakes have instead is lateral capacity. These buildings “give into” the earthquake forces by allowing incremental low-level damage in the form of the “working” of the disparate assembly of brittle materials. Although the masonry and mortar is brittle and the individual timbers remain elastic, the system behaves as if it were “ductile.”<sup>2</sup> If it works properly during an earthquake, the process can be carried on for a long period before the degradation advances to a destructive level. Thus, the buildings overcome the earthquake simply by not fully engaging with it. In addition to dissipating energy, the high level of damping reduces the danger that the building will resonate with the ground. Simply stated, that is the difference between strength and capacity.

The problem with allowing for the “working” of a structural system based on low-strength unreinforced masonry in the modern world is that the ultimate capacity of such walls cannot be easily modeled mathematically. It is not a capacity that is in any way based on the initial lateral strength of the system within its elastic limit, and its post-elastic behavior cannot be easily quantified, as can that of steel, for example. This is inherently messy from an engineering practice point of view. The behavior of these buildings relies on a disorganized combination of materials being stressed in tension, compression, shear, and bending all at once.

These principles of energy dissipation and damping have been well understood engineering principles that have been embraced with increasing frequency in contemporary seismically resistive design, but they have only rarely been accepted as relevant to the analysis of historic unreinforced masonry construction. However, it is the movement and cracking of the masonry, or the wood/masonry combination, is the means by which the system has frequently demonstrated its capacity to resist catastrophic damage in large seismic events. The full meaning of this difference between perceived failure and earthquake resistance was demonstrated most by a comparison between the damage (and people’s responses to it) in the Kocaeli Earthquake and a much smaller earthquake in and around the village of Orta, north of Ankara, rather than just the study of the Kocaeli Earthquake alone. This issue will be discussed more thoroughly below.

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<sup>2</sup> A comparable point can be found in (Aytun, 1981). Aytun credits the bond beams in Turkey with "incorporating ductility to the adobe walls, substantially increasing their earthquake resistant qualities."

## The Orta Earthquake of June 6, 2000

The earthquake that struck Orta measured only 6.1 on the Richter Scale (USGS website). It was small enough to escape international attention, but because I was close by when it happened I had the opportunity to pay a visit to the damaged area within 24 hours of its occurrence. This allowed for an unparalleled opportunity to survey the damage before any of it had been altered. The level of damage to buildings of traditional construction, including infill-frame construction, appeared to be higher than expected – initially shaking my confidence in resistance of those types of buildings. The few modern reinforced concrete buildings in the area showed comparatively little damage.



Interior of "huniş" style house after earthquake  
Orta, Turkey

On closer examination, however, an interesting point of comparison gradually came into focus between the damage scenarios of this earthquake and the much larger Kocaeli Earthquake. Part of the reason why the damage in Orta seemed so extensive was that the typical construction for the barns and outbuildings was of a rubble stone masonry that offered little resistance to earthquake damage. The traditional construction houses in Orta were almost all of infill-frame construction, and these generally fared better. There was, however, widespread cracking and shedding of plaster and stucco, with some disruption of some of the masonry infill. This was hard to explain in the context of the observation eight months before that showed that those infill-frame houses subjected to the full brunt of the Kocaeli Earthquake showed about the same level of damage as the houses in Orta. This equivalency stands against the background where the multi-story reinforced concrete buildings in Orta were not damaged or only lightly damaged, whereas a vast majority of those in the areas of intense shaking from the Kocaeli Earthquake suffered partial or complete collapse.

What, if anything, can explain this discrepancy between the comparative performance of the infill-frame buildings and those of reinforced concrete in the two earthquakes? When looked at alone, the Kocaeli Earthquake provides evidence that the type of reinforced concrete-frame construction used for most of the modern multi-family, multi-story housing blocks in the rapidly developing industrial areas of Turkey affected by the disaster (as well as in most parts of Turkey overall – and many parts of the world) are of poor design and of particularly poor quality construction. They have proved to be particularly vulnerable to earthquake forces. Likewise, the Bhuj Earthquake of January 26, 2001 showed the similar vulnerability of that form of construction in Gujarat, India. By linking this together with the Orta event, a further observation can be made – one that is not often realized when the larger event is looked at on its own. The modern reinforced concrete buildings go from performing well in a moderate seismic event, to being lethally dangerous in the large event.

In other words, what seems in Orta to be minor cracks may in fact be the onset of damage that, in a larger event, would have rapidly lead to the collapse of the building. This observation is reinforced by the fact that many of those buildings in Düzce that were damaged in the Kocaeli Earthquake collapsed in the Düzce event three months later. By comparison, the traditional infill-frame structures appear to demonstrate a greater ability to sustain an increasing magnitude and duration of shaking, without progressing much beyond the level of damage sustained in the more moderate Orta Earthquake.

The work of a unique survey by Turkish researchers Gülhan and Güney show that in one district in the hills above Gölcük (a city with some of the largest loss of life), where the soil was firm and the shaking less than in the city center itself, of the 814 reinforced concrete 4-7 story structures, 60 collapsed or were heavily damaged and 70 were moderately damaged,

while only 4 of the 789 2-3 story traditional structures collapsed or were heavily damaged and 5 were moderately damaged. The reinforced concrete buildings accounted for 287 deaths against only 3 in the traditional structures (Gülhan & Güney, 2000). The numbers of structures was almost evenly divided between the two types. This comparison is useful because the numbers of each type are almost evenly divided, and the size of the reinforced concrete buildings in the outlying areas are not as large as in the city center, making for a better comparison.

In another district in the heart of the damage district in Adapazari, where the soil was poorer, this research shows that of the 930 reinforced concrete structures, 257 collapsed or were heavily damaged and 558 were moderately damaged, while none of the 400 traditional structures collapsed or were heavily damaged and only 95 were moderately damaged.

From the technical level, the conclusion that can be drawn from seeing a similar level of damage to the traditional buildings in both the large and the smaller earthquakes, when the modern buildings show a progression from minor damage to destruction, is that the most important protective characteristic of the traditional construction may indeed be its ability to dissipate the earthquake's energy over a long period, without undergoing a rapid structural degradation. This has proven to be true, regardless of the level of shaking. In effect, such buildings are able to take significant abuse whereas their modern, but not very well constructed, reinforced concrete neighbors show evidence of undergoing a rapid degradation of their structural systems over a short period – if the shaking is strong enough.

### **The Bhuj Earthquake (India) of January 26, 2001**



View of the center city of Anjar, India, showing destroyed stone and reinforced concrete buildings.

affected Kutch District around Bhuj, or alternatively, its resistance against earthquake damage was ineffective or overwhelmed.

In Bhuj, Anjar, and Bachau, the three cities surveyed, the building stock was made up with an almost equal variety of older stone masonry and reinforced concrete structures. Often, reinforced concrete additions were constructed on top of earlier stone masonry. For the masonry, rubble stone in mud or weak lime-mud mortar was predominant. For the reinforced concrete, frame construction with brick infill (no shear walls) was predominant. In the areas of greatest damage, the rubble stone buildings were shaken to the ground, or separated apart into discrete unstable elements. More formal buildings with horizontally bedded ashlar walls performed better, but sections of their walls were often blown out. The concrete

With respect to India – following the devastating earthquake to strike western Gujarat in January 2001 – the scene of devastation was equally appalling, but different from that in Turkey. Unlike the damage districts in most recent earthquakes, this earthquake left many areas – including one whole small city – Bachau – completely leveled. As far as the eye could see, both modern and pre-modern buildings were leveled or partially collapsed. It was an awesome sight. It was immediately evident that either the type of timber reinforced masonry construction did not exist in in the earthquake-



Bhuj Hospital, a masonry building without timber lacing, showing effects of the earthquake

affected Kutch District around Bhuj, or alternatively, its resistance against earthquake damage was ineffective or overwhelmed.



Swaminarayan Temple showing its infill frame building surviving with very little damage behind a portion of its reinforced concrete addition that collapsed. Bhuj

structures appeared to have collapsed just as readily – particularly if they had been added on top of rubble stone.

After closer examination, it became clear that the timber-reinforced style of construction, either the bearing wall type with horizontal timbers, or the infill-frame type, was extremely rare in Kutch. The one example found in this survey was part of the Swaminarayan Temple in Bhuj, dating from the late 18<sup>th</sup> or early 19<sup>th</sup> Century. This structure survived the earthquake practically unscathed, while the modern reinforced concrete section of the complex partially collapsed.

In Ahmedabad, the situation was very different from that in Kutch. Ahmedabad was shaken badly enough to collapse a number of major reinforced concrete apartment complexes with soft stories and other poor details, but the historic walled city section survived nearly intact. Of the tens of thousands of buildings in this area, only one is reported to have collapsed. The earthquake shaking in Ahmedabad was significantly less than that in Bhuj, but nonetheless, the performance of the historic Ahmedabad infill-frame buildings was notably better than the rubble stone buildings in Kutch.



View of masonry house in Ahmedabad showing the timber beam that had been imbedded in the mortar.



House with timber lacing in Ahmedabad

Among the surviving masonry buildings in Kutch, however, there were a disproportionate number of buildings with balconies. This feature illustrates that, even when the damage in a district was almost total, the differences between whether a building collapsed or not could often be determined by something as simple as having the joists continue through a wall to support a balcony, rather than terminate in shallow pockets. What this observation shows is that even in a profoundly devastating earthquake, the kind of difference in design that can reduce the risk of collapse may be something that is neither rare nor particularly sophisticated. The basic protection provided simply by strapping a building together might be all that is needed to reduce losses substantially – which is exactly what the timber does in the masonry construction in Turkey – and Ahmedabad.



This balconied house in Anjar survived two large earthquakes that destroyed the city.

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### Improvements in new construction based on precedent

In the end, one may wonder: why it is important to study the seismic resistance of archaic forms of construction that are not in wide spread use or acceptance today. Is there anything from it that can be imported to current construction practice for new buildings? I believe there is.

Embodied in the typical timber frame, masonry infill building is the use of fired brick or hard stone masonry, soft mortar materials, single-wythe construction, and the subdivision of the infill wall into small panels rarely more than two feet (60cm) in width and half a story in height. The standard modern reinforced concrete frame construction commonly found in

Turkey, India, and many other seismically active areas of the globe, is also a form of infill frame construction. However, in this modern construction, the infill is not considered as part of the lateral resisting system. Rarely are the infill walls subdivided, and sometimes, to avoid damage to the frame from the “diagonal strut” effect, there is even a separation of the infill from the frame. In Turkey, the infill walls are most often constructed using a very thin-walled hollow clay tile that had the strength and brittleness of a dinner plate. In India, solid brick was more often used, but the brick was fired at a low temperature, and thus very weak.

While the infill in modern construction has often performed notably badly, it is the infill in traditional construction that has performed comparatively well. This observation raises two important questions: (1) Is it possible to bring into the reinforced concrete construction arena some of the performance characteristics that have made the timber frame infill construction work relatively well? (2) If such can be done, is the effort worth it? Research and testing is necessary to fully answer these questions, but I believe that from the evidence that already exists there are lessons that can be learned from the traditional construction that can improve modern construction – particularly in those countries where concrete practices are poor, and where the unregulated building development and lack of enforced building codes prevent even a minimum level of quality control.



RC construction in Golcuk after earthquake showing collapsed infill wall.

The principle lesson is that strength and rigidity are less effective in ordinary and unregulated construction than is flexibility, ductile behavior, and cumulative non-destructive damping. The object of the effort is to make the infill walls act not as shear walls, but as “cross walls.” By “cross wall,” what is meant is that they form a secondary element within the structural system that can give slightly in an earthquake without losing its strength or stability, but which can engage the frame with ever increasing resistance as the frame deflects. It can also dissipate large amounts of energy from the friction of the panels with the studs and cross beams, and the sliding of the masonry along the mortar joints.

The types of modifications that can accomplish this improvement in the performance of multi-story reinforced concrete construction are: (1) the introduction of subdivisions (with steel or pre-cast concrete studs and cross-beams) into the infill wall, (2) disallowance of the use of masonry units that are weaker than a certain minimum, and avoidance of the placement of perforated block with the perforations running horizontally, (3) the use of mortar that is significantly weaker than the masonry units, avoidance of the use of more than a limited amount of Portland cement, (4) placement of the walls, where possible, within the structural frame, and, for walls that do not terminate at a structural column, use of a boundary element connected to the frame, and (5) tying of all window and door lintel, and window sills to studs or columns that run from floor to floor.

### Conclusion

Humility and respect for the work of generations past is an essential prerequisite to full understanding of the contribution that traditional construction can make to the future. So much of the world’s pursuit of “progress” has been fueled by a belief that those of us alive today know more and do things better than those who passed before us. To arrive in a scene of such devastation as witnessed in Turkey after the great earthquakes of 1999 and see these unsung and unnoticed indigenous brick and timber buildings standing among the ruins of the modern ones around them should alone be enough to give anyone pause. These were not

sophisticated buildings, and they certainly were not engineered in any formal sense of the term. And yet, they had withstood an earthquake that brought down many of the more sophisticated buildings around them.

As we look for solutions to the problems that have been so profoundly thrust on so many by the tragic earthquakes of last several years, it is important to be open to receiving what the wisdom of the ages may have infused into traditional structures. From this awareness there may indeed be some lessons that can be learned, even in this over confident age. And in the end, the most valuable lessons may be found in something so obvious, simple, and low-tech that it has been easy to overlook.

It is so easy in our time of powerful images and superficial cinematic effects to believe that the cultural value of indigenous national styles of architecture lies only in their visual image. However, it is not enough to preserve isolated examples of historic vernacular buildings solely as if they are animals in a petting zoo, or, worse, to paste cute details borrowed from such architectural traditions onto the facades of buildings constructed using non-traditional technologies. There is more to the traditional buildings than their veneer. Understanding their structural characteristics is, in so many ways, like coming to know someone in person, not just from a reflection in a mirror.



Fanning family in Ordu standing in front of their "birney" house. The working of the masonry is visible as cracks in the stucco.

In the final analysis, an understanding of pre-modern building technologies can provide an opportunity to step back for a moment to evaluate where we are now, based, not just from a narrow view from the commonly accepted standards of our time, but in comparison with all time. In so doing, we may be able to discern the loss along with the gain, and thus re-capture some of the quality of

inventiveness that is manifest in the traditional buildings of so many national cultures. Only then, perhaps, will it be possible, once again, to create new buildings that reflect the identities of their local cultures, rather than add to the detached and ahistorical uniformity that so often characterizes the modern buildings that are now so often interchangeable the world over.

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