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STEPWELLS IN WESTERN INDIA

Ranki Vav at Patan

Rabindra Vasavada[1]

Introduction

The history of traditional Indian Architecture is rich with the examples of the building enterprises promoted by the rulers and the rich people to provide for the basic needs of life of people at large in towns and villages. This was also considered as a benevolent action patronized by these nobilities to record events and or commemorate the legendary people in whose memory such buildings were built. These included tanks, reservoirs, wells, stepwells, parks and gardens, etc., which were constructed to provide the basic necessities of life of people living in towns or the travellers who traded the routes in earlier times. The urge for such benevolent act was also seen in the context of the good practice of leadership and community welfare, which was accepted as a moral duty by all those with surplus means and those belonging to the ruling class. Thus, public welfare or utilitarian architecture forms a large body of built heritage with typology of structures which are exemplary and also a rich source of traditional knowledge offering us a vast resource in present times to appreciate and understand the traditional practices of public governance and resultant building arts and engineering sciences, which were employed with immense technical and craft skills to realize these construction enterprises in different regions.

The western Indian region, because of its long history, has a rich heritage of such architecture. During various phases of its past, the region was ruled by important dynasties, which had good governance and prosperity. Records of such phases exist in the form of built environment, which date back to early centuries providing us the glimpses of historic traditions. These traditions also show an evolutionary scenario, which provides an interesting case for the study. For this reason, the subject of this study is focussed on one such traditional utilitarian building type, that is the stepwells in western Indian context, with a regional focus on present northern Gujarat or Gurjar, as it was historically defined, during the Solanki rule (c.11th century) with evolving trends continuing well past the mediaeval phase in Gujarat.

Stepwells are constructed in areas where water is scarce. Many times, this was a benevolent act by wealthy people and the kings to offer sources of water for people and also for farming. These were many times constructed on trade routes to facilitate the needs of travellers. The well-digging and the construction of such stepwells followed the scientific principles of underground water streams and the community of well-diggers in many regions in western India were well versed with the knowledge of the existence of underground streams and the techniques of well-digging. The region in western India provided reasonably good soil conditions with sufficient cohesiveness of soil and excavation would not confront any rock-bed. In such soil, the excavation cuts do retain the strata of soil intact even after the pits are dug, because of the inherent cohesive strength of the soil. If soil strata is cohesive, and the side angles are correctly judged for their depth for natural retention, then the construction amounts to only lining up the excavated sides with masonry walls and nature of this wall is not a retaining wall, as it is not required to retain any additional pressure, which would be developed as it does in any condition of imposed filling of earth. From the observation of the stepwell structures and the failures of the side walls, the following could be easily observed:

- a The side-wall construction is simply a masonry wall (blocks placed over one another with tight joints) with no extra provisions of dowels, etc.
- b The intermediate pavilion structures are placed across the well to provide for shaded places between the flights of the steps. These pavilions are simple structures with columns and beams with stone plate roofs – all constructed into a tiered assembly, simply supported structures.
- c The general cross-sectional profile of the stepwell is narrowing down as it goes down. This narrowing actually results in stages of floor sequences by which the well is tiered. Each section of tier is marked by a ledged projection giving the entire side wall a stepped profile. This taper line also coincides with the retention profile of the soil in which the well is dug. In some of the examples of the wells, which are actually cut out in rocks (e.g. Adi-Chadi Vav in Junagadh, also perhaps an abandoned quarry site) such tapering profile is missing, as obviously it is not required.

The stepwells are connected to the main well, a cylindrical shaft reaching to the natural underground stream, which is normally tapped for a constant water supply. This is the decisive factor in designing of the stepwell, as it is this depth of the natural stream, which governs the expanse of the stepwell structure. In a normal stepwell, the flight of steps leads to the last portion connected with this cylindrical shaft of well. This is devised as a kund, which stores the surplus water overflow from the well for easy access for users. In some wells, this kund also is connected to a natural stream underneath. The kund structure is approachable from three sides making the access to water easier to many people at a time.

There are several types of shapes preferred for a stepwell. The most common type is a linear one with access on one end and the cylindrical shaft at the opposite end. There are stepwells, which are broken into two sides in a right-angled shape. There are also more elaborate ones with entrances fanned out in three directions, which are attached to a linear stepwell. This basic type must have had its profile logic dependant on the available land and the patrons' ideas on its details of construction and elaborations.

Irrespective of the size, the level of details and overall shape, the constructive logic for stepwells all over western India has more or less remained constant, and there is a strong sense of tradition in architecture of this utilitarian structure. The fact that these were constructed as a public welfare measure by the rulers and/or the nobility of the community, is amply justifying its location along the important trade routes in western India, which as a region, was always in shortage of adequate potable water and such a means to make water available to public at large was a welfare gesture on the part of people with surplus means and wealth.

Stepwells were constructed, as already known, an adjunct to the main wells, which were sunk in the ground up to the depth of the perennial underground streams to obtain a constant source of water in a region, which otherwise had no perennial rivers in the region. The stepped corridor attached to the cylindrical wells provided easy access for people and provided water for the irrigation needs, to a limited extent, for the surrounding fields. A stepwell is an underground structure with flights of steps interspersed with landing or terraces to provide comfort to the users while ascending or descending the stairs. Normally in its simplest enterprise, it is only having steps, terraces and a well shaft. Its most complex form is a series of multi-storied pavilion structures on the landings, starting with an elaborate entrance archway, broad articulated flights of stairs with even lateral and axial steps, and highly decorated side walls, which are conceived in form of a series of niches along the length of each tier. These walls are also stepped in transverse direction to reduce the constructional operations from the ground to the deepest level. These various levels are connected by several sub-stairs, which provide intermediate linkages for circulation.

The smallest stepwell exists near the Sun Temple at Modhera and the largest in the region exist near Sahastraling Talao in Patan, both built during Solanki Period (ca.11th century) and are some of the most notable structures in the region. Our heritage of underground water structures built in western India is rich and varied and is a valuable source of knowledge for students of architecture, art and culture. Stepwells, wells and related underground structures were built by different rulers in several phases of its history in western India as part of their duty towards public welfare so that potable water, at times, scarce, was stored for the well-being of people. In building these structures, they perpetuated the memory of a departed king or nobility and thereby fulfilled their obligation towards their people. This also acquired added significance for rulers as these structures became commemorative in their meaning. This resulted in exhibiting a very high level of skilled craftsmanship and ingenious methods of building. Stepwells and such structures existing today are thus a very rich source of history.

Historic examples of stepwells

As is always the case with buildings, there are examples which are a direct response to the need, and there are examples which are the result of articulated design efforts consciously built. In case of such utilitarian structures, there are instances of steeped wells, which are 'found' in nature and by slight variations humanized for the purposive intentions. One such an example is the famous Adi-Chadi Vav situated in the northeast corner of ancient Uparkot in Junagadh. After observing it for many years and wondering about its structured parts and the sides, which appear as natural rock formations, I used to always wonder about its realization. After very careful observation for a few months, I had found that the well shaft was an adjunct to one of the bastions of the fort. The bastion was actually constructed over the rocks, which were at the foot of the wall base. This rocky ditch also was the conventional well shaft of not very great depth but a shallow bowl, which would be good enough to store the rainwater. Up to the rim of the rocky shaft were the narrow crevices acting as a shaft which must have led to the depths of the rock, possibly as a stone quarry as the sides of the crevices clearly show even today the marks of the quarrying of stone slabs which must have been used for the construction of the buildings within the fort in earlier times. This was also a common practice. The periphery of the fort still has at many locations the abandoned quarry sites which also acted as a barrier for security between the wall and the hills around. So, in my understanding, this well or the stepped corridor must have been appropriated as a source of water after a quarry was abandoned by cleverly articulating it along with the bastion of the fort wall. The faces of the sides of the crevices are natural rocks, and the steps are all carved out of the gradient surface of the rock. The water within the well is augmented by rains, the well shaft-the cylinder is the only masonry-built structure, which is part of the fort wall construction – a very thoughtful and utilitarian solution to the need for storage of water for the year-round consumption. This somehow throws more light on the ingenuity of the builders and their common-sense approach to such utilitarian building efforts. Adi-Chadi Wav is actually a pair of stepwells in the same area, wherein the other one is engulfed in thick vegetation and much smaller but a regularly built stepwell which does not attract much attention from tourists as it is a secluded structure, even though methodically built. The main vav offers – by its shear ruggedness and natural form – a thrilling experience as a natural formation of a crevice in a solidly built hilly rock formation. There is also another spiral stepwell known as Navghan Kuvo a rock-cut well of immense depth with peripheral steps around its shaft to go down to access the water. Although not classified as similar to stepped wells, this example is worth noting here as it is immensely deep cut into rocks in ancient times to tap an underground stream to assure perennial water supply. This well, from a square to a circular shaft, goes to immense depth (from hilltop to natural ground strata) and to access the water level. There are very interesting series of flights of steps around the well shaft which take people down. The arrangement of steps within the cavity of the shaft is along the length of the sides, cut from rocks perpendicular to the side, every time going down a few steps in a zigzag manner through a series of small straight flights which take away the possibilities of fatigue or vertigo effect which many times people suffer while going down a spiral. This arrangement also helps in going deeper in a relatively less lengthy flight of stairs. This ingenuity of design makes such structures wonderful for us to appreciate the design capabilities of people in earlier times. The main well shaft is approached by a series of surrounding stairs which work around the hills and bring the visitor to a large area from where one descends through a straight flight down to the well shaft before one begins the descent around the well proper in the peripheral cavity down to the hidden depths of the well. The whole haptic experience resembles a journey into the '*patal*' or the subterranean depths, and that is why this is also known as '*patalkuvo*'.

Between these two extremes are the countless numbers of examples of such structures, built during the last several hundred years. Some of which still exist for us to understand the whole sphere of such utilitarian architecture in western India. The typology of such structures has developed depending upon the nature of the site, the extent of the need and patronage and the available relevant building options. As mentioned earlier, there are, depending on the above two basic types, linear and angular stepwells. Within these two basic types, there are a number of variations which differ in detailing of these two basic types and based on that, these types get further categorized. The basic elements of these details are the entrance area; the arrangement of the stepped flights, the pavilions, the side walls (tiered or straight), the kund and the main well shaft. At times, depending on the location of the well, there used to be small structures was mounted atop the pavilions. Also depending on the size of the well it was a common practice to link the well shaft with the irrigation needs for the adjoining fields and for this end, platforms and canal network around the main well was also constructed. The length of the side walls was also raised above the prevailing ground level with a narrow platform and a low parapet wall constructed as a detail to the platform. On the entrance, therefore, there were steps provided leading up through an archway to the platform and then the descent to the stepwell offered. These simple details avoided any chance of the surrounding surface runoff water or drains getting into the well through the steps.

Attitudes toward construction of stepwells

The understanding of the environment and ecology of this region in the minds of the experts in those times facilitated such enterprises without many incidences of errors. The whole issue of sensing the presence of underground streams, (though projected as a mystic ability of a few water 'diviners') was actually part of a well-understood science (Science of Underground Water) laid down in the Vedic texts and like the building sciences, canonized for observations by experts with the help of the presence of natural flora and fauna of that region. This observation-based knowledge codified conditions affecting the naturalness of a place and observing the presence of specific streams, rivers, trees and plants and insect life, one was able to predict a specific type of subsoil water resources. This was in a way an ecological observation and since all the living-forms primarily required water to sustain life, their life pattern in a specific region and thus they indirectly helped human beings to anticipate natural sources of water by their own presence. This ability to anticipate life sources by the awareness of the ecological conditions was extremely sharp in earlier times and it was an innate ability of few sensitized individuals, who acted as experts in the field. These experts assisted the identification of the sites, where water sources could be discovered and depending on their judgment, the well-sinking sites were determined.

As described earlier, the construction of the stepwells as an adjunct to the main well determines the extent and the type of the form assigned to it. The enterprise depended on the patronage by which it was realized. The size, the extent of the detail, materials employed and its significance in the users – all resulted from the patronage and the importance of the structure in the region as a source of water and rituals associated with it. Depending on the site on which it was built, the form was decided, whether linear and multi-directional approach, linear and single axial approach, angular with flights turning at right angles to accommodate in a shorter piece of land or otherwise. The basic source in all these variations remained the main cylindrical well, which actually fed the stepwell for providing water.

The soil condition in which the stepwells were constructed provided the inherent characteristic of its strength and feasibility in well-sinking. The soil presupposed a composition, which due to its natural quality, was a mix of sand and clay, which had tremendous cohesiveness for retention of its compactness. This provided enough stability at the outset while working on devising such a constructional enterprise, and the builders of that time had sufficient knowledge about this from their practical experience with well-sinking operations. Their understanding of the nature of soil, and their judgment in handling the extent of such soil has resulted in structures, which after centuries of existence are still flawless and strong enough, hibernating in the soil.

The materials employed for the construction of the inner lining of the excavated trenches for the series of flights and for the steps within the flights leading to the well were normally good-quality stone available in the neighbouring region. The storied pavilion structures on the landing areas between the flights of the steps are also constructed from similar stones with pillars, beams and slabs of the same stones into a multi-storied open structure. The construction of the side masonry walls employed an interesting but simple method of construction. The length of the side walls was interspersed by the pavilions of the landing areas and the vertical dimensions were layered into masonry courses and interjected through courses of stones which went into the sides of the soil mass and held the lining courses together. These ledges or through courses were expressed as bands with decorative mouldings at every floor height of the corresponding pavilion floors or even as intermediate bands between the floors as is required in a specific instance of the structure. In many cases, the horizontal dimension of the sides is conceived in the form of panels with niches between those bands of the through courses, which in such cases provide further details to the side walls where positions for sculptures and statuary are devised to further detail the walls and the environment of the stepwell on various levels of its structuring. From the peripheral platform, there are many times small servitude stairs-mostly spiral or in some cases a straight flight ones, which serve as quick accesses from one level to another for people in day to day use. These stairs are located at places near the main well shaft or otherwise between the successive levels of pavilion floors for easy circulation between these levels.

In many examples, the well shaft provides for the linkages for the provision of additional needs for irrigation of the field around for agricultural purposes. This requires the additional construction of the platforms around with facility for drawing the water out from the well by animal power or through a water wheel, which was also a practice. The area on the ground along the sides of the stepwell is normally marked by a parapet and a platform, and the entry point to the well is provided with an entrance arch or a pavilion structure marking the arrival place. In some instances, the portion of the pavilion above the ground is also finished with a pavilion structure (a small temple also in case of the small stepwell near Sun Temple at Modhera). This also helps passer-by to identify the existence of such an underground structure form a distance.

These structures provided areas for people to spend leisurely time and conduct rituals connected with the worship of the deities installed within the wells, which was a common practice. Association of cult deities and Vishnu as protector of life provided his special position in such structures and thus these structures assumed social, utilitarian as well as religious overtones. The construction of the facsimile walls also thus provided niches and alcoves, which were the positions to install sculptures of the incarnation of gods, goddesses and their entire entourage. The structure so constructed not only remained a mere well but a social space with overlapping purposes and this was the specific contribution of such well-types as an important expression of the utilitarian architecture of this region. The structure also became a meeting point for contact for many travellers who travelled on the trade routes along which these wells were located near towns and cities.

Ranki Vav (Queen's stepwell) at Patan

Location and site

One of the largest of such stepwells is the Queen's Stepwell at Patan, which was unearthed by the ASI in the early 1980s. It is located near the ruins of 'Sahastralinga Talao' (a large man-made tank with 1,000 temples on its peripheral bank). This structure is of immense size, built as a public welfare measure by Queen Udaymati to commemorate her husband King Bhimdev Solanki in later half of 11th cent. Being an enterprise through royal patronage, it assumed tremendous significance and was accorded excellent skills and craftsmanship in its execution. It was also thought to be a major water resource considering its depth which was about a hundred feet, and as result, its stepped corridor required almost double the length to provide easily accessible flights of stairs, which combined both longitudinal as well as sideways integrated latitudinal steps into a very intelligent mix of descending order to restrict the length of stepped corridor from becoming too lengthy. The entire conception defies our imagination today as the entire structure was finished in series of storied pavilion structures interspersed with flights of steps with intricate network of subsidiary circulation stairs between the various levels of the pavilions and the lowest kund in front of the main well. The main well was conjoined by a *kund* structure between the flights of the stair and the last pavilion structure. Such *kund* were filled from water overflowing from the main well were also many times having a direct natural underground stream tapped with them to augment the main well. This provided the source as in this case and the *kund* was also proportionately larger and a significant part of the overall design. The entrance to the stepped corridor is marked by a large 'torana', an entrance arch supported on two freestanding pillars, which must have marked the entrance to the entire structure (a base of one such pillar is still found at the entrance). It was a common practice to treat the entrance of such a complex with an archway at the point of entrance in the architectural idiom during Solanki rule.

This stepwell is one of the largest stepwells in this region, built in 11th century (AD 1062) as a public welfare measure by Queen Udaymati in the memory of her husband Bhimdev Solanki, the ruler of Patan situated in north Gujarat. Not very far from Modhera, Patan was the capital of this region during Solanki Period and was a flourishing city adjoining Anahilwad. Siddhapur, situated to the east of Patan, was also an important town in this region with Solanki rulers and both these were sister towns in close proximity. The stepwell is located on the banks of river Saraswati and bordering the great *Sahastralinga* Lake, which must have been a very large source of water which was filled by diverting the water from river Sarswati during the monsoon. The fragments of this lake are opened by archaeologists, which suggest the immensity of such enterprise which must have been constructed earlier in this region. The stepwell constituted one part of the water system, as an adjunct to the lake and more approachable to the people for their daily needs, while the lake provided for all the routine service functions at the larger level. The stepwells provided essentially for potable water tapping on underground stream, which was considered more precious than the runoff rainwater collected in the lake diverting it from river Sarswati in this case.

The stepwell

The Queen's stepwell is a conception of immense size. The depth of the well also must have been considered keeping in mind the long-lasting availability of an underground stream so that the facility remains functional for centuries to come for the everlasting memory of the ruler and his glory. It is this factor which also necessitated a very large stepped corridor to descend up to the water thereby requiring a number of storied pavilion structures to interspace the stepped flights of the corridor. The entire conception thus resulted in a very elaborate system of circulation between and across various levels of the multi-storied structures. The basic elements of the well fit into the typology of the linear stepwells. The stepped corridor, the original seven floors of pavilions out which the upper two were destroyed, the *kund* (probably with its own underground stream to augment the well) abutting the main well as you descend down and the cylindrical main well, all placed along the east-west linear axis with the main well on the west and the descent from the east. Most obviously, the routes from the river to the town must have been on the eastern sides, which are now blurred, and it is difficult to deduce these aspects. It is also common knowledge that these wells were situated on important cross-country routes and understanding the earlier route systems in the light of the *Sahastralinga* Lake, the *Roza* in the riverbed and the stepwell would be an interesting exercise to pursue.

The structural form of the walls of the north and south sides in such an extensive building has been carefully segmented out by floor heights, which project outwards as the steps go down in order to systematize the excavations. The niche-widths in vertical and horizontal dimensions are devised as panels for the side walls which have elaborate systems of niches in pilasters and intermediate bands to structure its superstructure. This has become a governing factor derived from the dimensions of available stones, workability of human efforts to build and the practicality of the soil retention. Out of these has emerged the entire range of scales for the detailing of panelled structures and structures of the horizontal ledges of the side walls which constitute the entire building operations. The pavilions are built out of a simple pillar and beam structure and the steps are all stone slabs dovetailed together using 'sisam' wood dowel pins embedded flat on the surface. In order to break long flights of stair required by the depth of the well, a system of steps is worked out laying steps in linear as well as lateral direction providing a great experience of looking at the sculptural galleries on the side walls. The niches structured in three layers have prominent middle layers, which house, at significant places the icons of gods, goddesses, guardian angels and a plethora of heavenly beings evocative of the entire physical and metaphysical existence within which our living environment is created and within which we exist. The entire conception of such a water structure assumes the meaning of a 'place' to nurture one's spirits on the higher religious-philosophical plane and at the same time provide for the most elementary need for water. The excellence of the craft employed; the skills of building, including the techniques of building; and the understanding of the materials and engineering science evolved through the traditions all put together captures our utmost appreciation and admiration at the dedication of the people and their zest for life in general. The in-between levels of floor-ledges are interconnected by stairs for easy connections near the kund side floors which originally must have been seven floors deeper. These stais provide direct quick access from the ground level to the lowest level without really always getting down through the main stairs. The entire structure was exposed in the late '80s, and it was fresh and new, and for several centuries, it was buried under the earth, presumably from severe flooding of the nearby river Saraswati. The damaged structure of the tomb, which was diagonally destroyed, provided a witness to such a massive flooding. The nearby ruins of the Sahasraling lake, which are also lying under the silt, provide evidences of such flooding.

Investigation in construction and structure

Several years ago, I got an opportunity to measure draw this stepwell in all its details. Later on, I also was able to construct a wooden model of the entire stepwell at a scale 1:50 to actualize the experience of construction through a miniaturized model. This pursuit led to a deeper understanding about such structures, and this one also being the largest of its type gave important insight into the scale at which this concept was stretched in construction and well-digging. At various stages of its structure, I could understand the attitudes in constructional processes as well as the kind of practical questions, which might have come up, and the solutions projected. The exercise of this nature and scale provided very useful knowledge which was shared also with the present generations of well-diggers whose insights also helped develop my understanding, though these practices are now a forgotten affair and with the disappearance of this old well-diggers the wisdom also would be no more available, and for this reason, it is very important to record this here for future.

Queen's stepwell, where only the main well existed on the surface, was lying unexplored until the late '60s. In the early '80s, the ASI undertook systematic excavation of this area and exposed the entire stepwell. Until then, only some fragments of the cylindrical well were evident on the ground level and this even Burgess had recorded in his report on this region. He also presented the woodcut of the *Torana* Pillar, which existed onsite at a distance along with his report on possibility of such a hidden structure. When ASI exposed the entire structure, the immensity and the realization that this was amongst the largest of such structures was established. It also offered an important example to study as it expressed the highest level of architectural achievement in this region, where typology of such structures was a common practice characterizing the regional needs and practices. In my inquiry lay some clues to understand the aspects of the making of such a structure. For example, observation of its location nears a river and a large tank, which constantly surcharged the aquifer in this region. As per the traditional sciences, this was one of the main considerations in selecting the site for such a structure. The soil in the region is also an important consideration. While exposing this monument, the ASI had done massive scooping out of the earth. ASI also excavated a 25-feet-deep trench 5-feet wide and 10-feet long to study the construction of the side walls. This trenching was possible, and it was observed that there were no signs of earth caving or even loosening of the trench sides even when the excavation was so deep. It was possible to see that the trench was extremely clear-cut in its profiles, and the soil adhesion was extremely strong, even when the trench was laid open for a considerable period of time while we were working onsite to measure it. As per the traditional science, the soil strata where such structures are constructed must offer adequate soil strength for cohesion, and it has to be a balanced composition of sand and clay with *murrum*. During the period of our site work of over two years, beginning in 1987, we saw the water level in the cylindrical well-sinking and towards the turn of the decade, we found the well going dry. This was obviously due to the exploitation of the groundwater sources by deeper tube wells in the vicinity of this site, which were dug in the surrounding agricultural fields. However, when witnessing the well bed, an important clue was revealed – a fragment of the wooden beams, lying in shape of a cross-buried in the soil bed of the well. The ASI staff had later dug this out as a relic and had no clue as to how such a deliberately crossed piece must have sunk in the soil bed and that too in such a lowest position. The inquiries to find the right people to discuss this naturally led to finding some well-diggers who would still be around and who can at least throw some light on the aspects of well-digging carried out in the traditional manner. Further inquiries led to a small town called Umreth near Anand, which happens to be a place where there are the deepest wells in Gujarat. Some groups of traditional well-diggers there provided some insights into well-digging with their understanding of the traditional ways. Akbarali and Mohammadali in Umreth, both in very advanced age, saw the photos of the wooden cross and expressed familiarity with such cross and explained its importance as the first act of building the cylindrical shaft from the level of the natural stream underground. They could hardly narrate their methods and I had to sketch it out to translate their description of the well-digging techniques. I discussed with them the systematic sequence first without really mentioning the fragment discovered and showing them the photographs. Both these old masons joined up in explaining the method from site selection to the completion of the lining and the platforms. Their faith in the vocational choice of site as identified by the observation of the region and the proximity of the natural surface water source was unfailing. To doubt such a choice was almost tantamount to doubting nature! The process they described from initial digging in suitable stages equivalent to a man's height until the underground stream is struck provided an insight into their practical considerations based on the soil conditions. This many times required the area of excavation reducing in the circumference at every stage to secure from any caving-in of the excavated trench. When they felt that they were about to strike the stream the soil became moist and wet and that is when the wooden wheel placed in loose wet soil provided a base for the masonry and it automatically sank in loose soil due to the weight of the masonry ring piled on it in layers after layers as long as the soil below it shifted and natural stream filled the water in the well. The upper construction sequence was the mere logical end to a practical beginning and was carried out to consolidate the excavated cylinder and to ensure the collection of water within without soil seepage to preserve the collected water. The masonry on the upper layers was always sealed with mortars joints also as a precaution against seepage of any surface water, which tends to be less purified than that of the underground stream. They initiated the process of upward cylindrical wall construction, which many a time simply served as hard lining of the excavated sides of the earth with open-jointed construction. This construction was masonry, almost certainly out of good quality stone in trapezoidal blocks placed with open joints in rings above rings. The stepped corridor was decided based on the available land for its length and the depth and the excavations were undertaken precisely in alternate compartments following the Man-height layers and the length of each flight of stairs. This excavation provided stability until the entire length of the stepped corridor was constructed. The pavilions of the landing portion were actually constructed out of pillars and beams in solid stone masonry. The extensively carved elements were assembled along with the structural parts forming the series of superstructure side walls and the pavilion structures depending on their depths. Thus traditional science suggested precise practical methods of construction, which the masons practised and understood very well. The whole problem and its solutions confirmed to the overall environmental considerations and the human needs within, and for this reason, the entire endeavour was an act of welfare for all in times to come as well as a very high level of skills and craftsmanship exhibited by its builders.

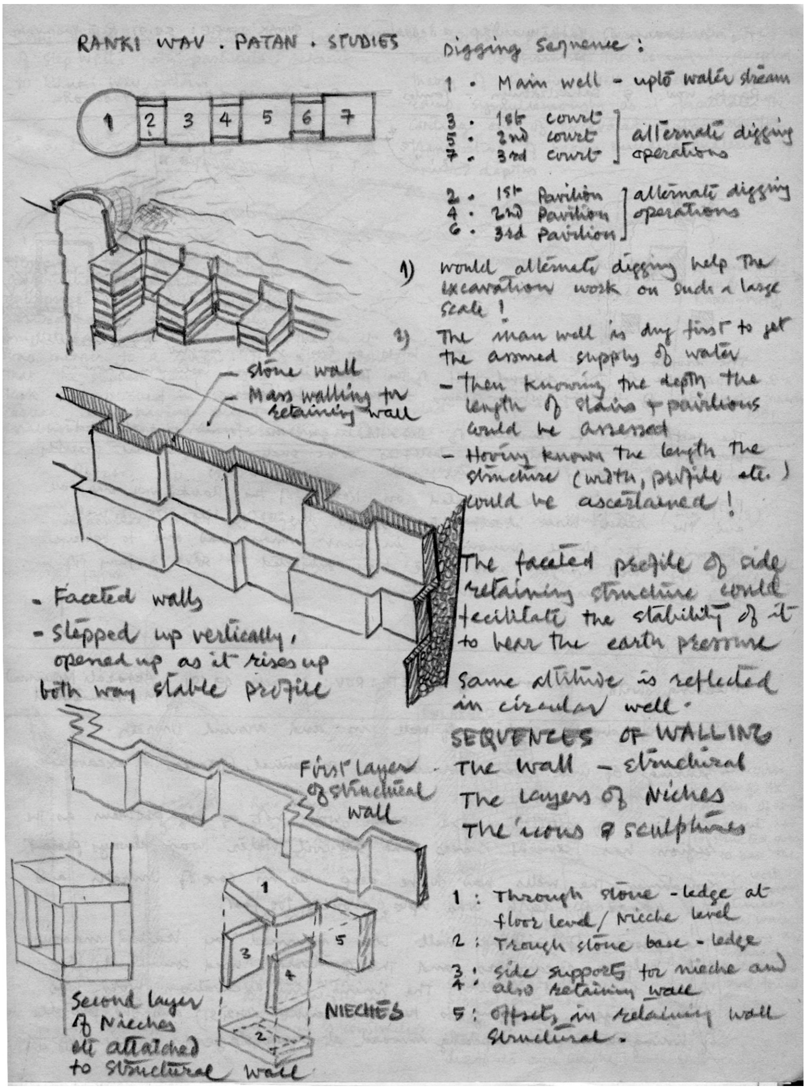

FIGURE 7.1 Ranki Vav structure

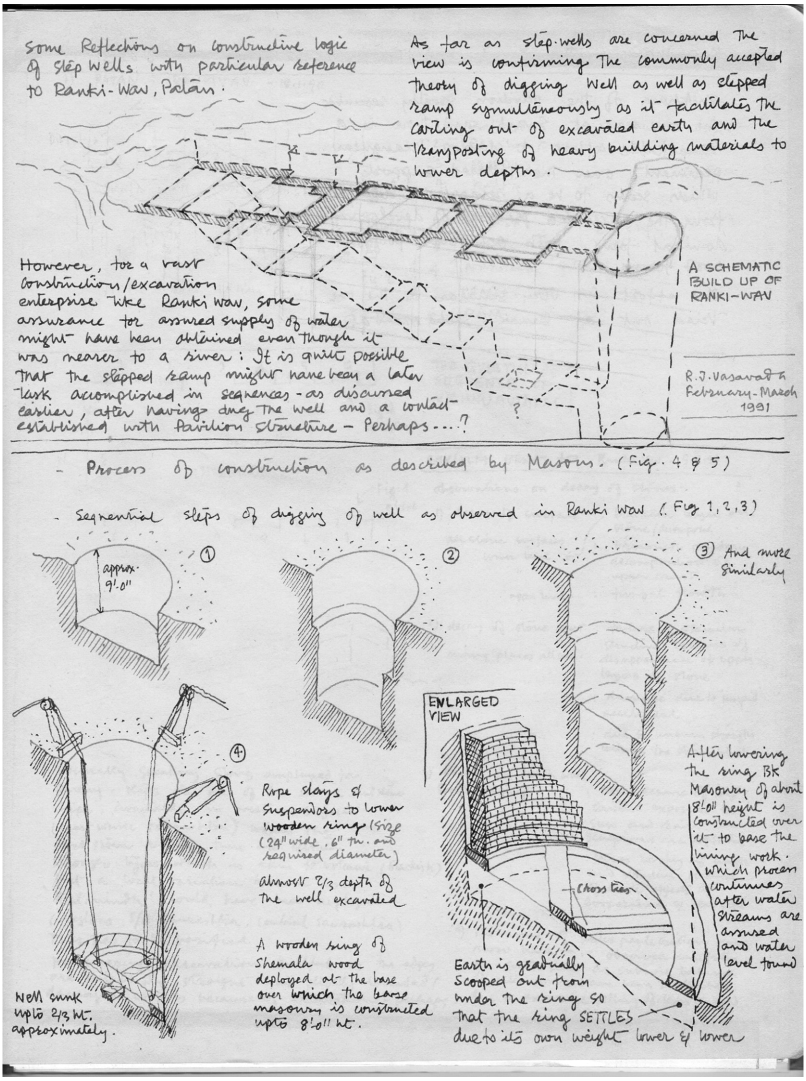

FIGURE 7.2 Constructive logic of Ranki Vav

FIGURE 7.3 View of stepped corridor from east

FIGURE 7.4 Stepwell shaft side view from west

FIGURE 7.5 View of Stepwell from northeast side corner

FIGURE 7.6 Lateral structure within the kund

Note

1 Author thankfully acknowledges the opportunity and funding provided by the

- Director Dr K L Mankodi and M. Postel of Project for Indian Cultural Studies, Franco Indian Research Pvt Ltd, Bombay, to measure draw and study the Queen's Stepwell at Patan.
- Indian National Science Academy, Ministry of Science and Technology Government of India for awarding me the Principal Investigatorship and National Institute of Design Ahmedabad and its Director Sri Vikas Satavlekar to offer Senior Fellowship at the Institute to carry out the study – Some Aspects of Utilitarian Architecture in Western India – and for administering my fellowship through NID as a Principal Investigator.

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