

A STUDY OF AUTO LEVELLING LASER IN CONTEXT OF BRICK MASONRY TO MAKE THE PROCESS INNOVATIVE AND SUSTAINABLE

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Abstract:

In this research paper I have tried to throw light on the residential construction industry in PCMC, Pune as overall industry is facing the challenges to achieve the quality of the work, meet the dead line of the project and more importantly complete the project within the specified budget as post covid the construction material cost has shoot up surprisingly high, so wastage or overconsumption of it should be avoided, as residential construction industry is mostly labour intensive industry and to meet the demand of skill labour work force is almost impossible so most of the work is done from the seasonal labours who migrate to the city from villages during the uncultivable period of the Year. Due to this unskilled labour the quality and speed of the work is hampered. This article has made all round representation of tools, equipment's and material which can be used to "kill the skill" in order to retain the quality, speed and budget of the residential projects and a specific focus is made on the Auto Laser Level (levelling device) in order to find out its sustainability in Brick Masonry process.

Keywords: *Brick Masonry, Auto Levelling Laser, Plumb, Line level, Mason, Plumb-bob*

1. Introduction:

With the continuous innovation by engineers and researchers in the construction industry this has lead to the advancement of technology which has revolutionize the industry and the way of performing the work and the use of alternate material as the natural material is getting scarce. Emerging construction technology is just not a fad or a fun new toy. There are real, practical applications and benefits to modernizing the current processes. Construction companies want to remain competitive and not be left behind, and they are finding ways to integrate new approaches into their strategy and workflows. These cutting-edge technologies in construction are drastically changing how the industry operates and how future projects will be performed. This high end technologies will save time, resources and cost for the complex projects but the initial costing for the procurement of this technologies is very high and technically advance staff is required to operate it and interpret the data acquired. Here our main focus is on the brick masonry process followed at site and the use of the technologically advanced tools and equipment's relating brickwork to make the process innovative and sustainable that will save the man hour, time required and will simply replace the traditional methods at present in use in construction industry which is too inadequate to meet the speed and quality requirements of the current situation.

2. Objectives of Study:

A. Primary Objective

- 1.To Study the Skills required by Mason for Brick Masonry
- 2.To Study the role of Auto Levelling Laser in Brick Masonry process.

3.To Study the ease in performing the Brick Masonry with laser level..

B. Secondary Objective

1.To Study the process of Brick Masonry followed at site.

2. To Study the challenges faced by Mason in performing Brick Masonry.

3. Research Methodology:

- Exploratory Research method has been used in this study.
- The universe for the present study consists of all the small (plot area below 5000sqft) residential construction going in Ravet, PCMC area of Pune. There are around 80-100 small construction going in this area. 10% of the universe has been considered for the sample frame. Thus sample frame of the study is 10.
- 10 Small residential construction from Ravet, PCMC were selected on deliberate sampling method. 10 respondents from these construction site mostly developer/ supervisor/ contractor were selected on the basis of their technical know how about the process.
- The selected respondents had varied experience in particular construction activity or whole building construction.
- The present research paper is based on both Primary as well as Secondary data.
 1. For Secondary data various websites, blogs, related online articles and research papers were referred.
 2. Primary data has been collected with the help of questionnaire .

The data thus collected has been studied, analysed and the outcomes of the same has been presented in the given paper.

4. Literature Review:

1) **Civil Concepts^a (www.civilconcept.com, 14th August 2022, 4.00pm):** Brick Masonry is the compound building structures constructed out of individual building units bonded together with mortar. Brick masonry is a type of masonry in which bricks are used as the building units which are bonded together using mortar.

Bricks used should be First-class this bricks have a standard rectangular shape and size, burnt red color with well-defined straight edges, and even surfaces. They do not absorb water more than 1/5th of their weight when immersed in water for 1 hour and do not show any sign of efflorescence in drying. They give off a metallic ringing sound when two bricks are hammered together. They should not break when dropped from a height of 1m.



2) Civil Concepts^b (www.civilconcept.com, 15th August 2022, 7.00pm):

Prepare a mortar mix of Cement sand ratio not leaner than 1:6 in water. The quantity of mortar prepare which should be finished within 30 minutes of the mix. Otherwise, admixtures are required to be added which prolongs setting time and workability.

- Place a 25mm thick layer of mortar on the construction line which acts as the level surface of laying the bricks.
- Lay the first course of brick on the mortar bed and shove them into the mortar to place them firmly, and fill the vertical joint.
- The recommended mortar joint is of 10mm thickness.
- Threads can be extended from one to another end of the structure to guide the construction and to ensure that the bricks are laid in perfect horizontal.
- Fill mortar on the frog of the previous brick course and lay the second course of bricks firmly on the mortar and fill the vertical joints.
- Level devices and water level pipes can be used to check the level of each course whether they are uniform or sloping. Sloping courses are not acceptable.
- Plumb bob shall be used to check the verticality of the wall erected. It can be used at the corners and other wall surfaces to check whether bricks are protruded out or not.
- The height of brickwork that is permitted to be erected in a single day should not exceed 1.5m
- The verticality of the wall erected should be checked in each course along with the level of each course.
- All the joints should be flushed properly and filled with mortar without leaving any cavities.
- The thickness of mortar joints must not exceed 13mm in any case and they must be uniform as far as possible.
- Frogs of the bricks should always face upward in case of header and stretcher.
- The wall should be truly vertical with each course adequately leveled.
- The thickness of each course should be uniform.
- Brick masonry should be regularly cured for 2 weeks.
- Brick masonry should be left with toothed ends whenever the work is halted.

3) Baseline Equipment (<https://www.baselineequipment.com/self-leveling-construction-laser-levels>, 9th August 2022, 11.00 am)**Auto Levelling Laser:**

Self-leveling, also known as automatic lasers, offer an unparalleled level of precision for construction and land surveying professionals. These units automatically find and keep a level within your desired range. As a construction professional, you can also disable the automatic leveling function for different manual tasks. These units can provide an accurate level on a wall or various other surfaces on the work site.

How Do Self Leveling Lasers Work?

Automatic leveling capabilities are possible using 3 main modes of action: wire suspended compensators, pendulum mechanisms using a gimbal, and electronic leveling.

- **Wire suspended compensator:** This mechanism is mainly found in older technology. It uses gravity to suspend a platform. Using prisms or mirrors, the platform works like a plumb bob and compensates the exiting light to be level with the entering natural or laser light.
- **Pendulum or gimbal mechanism:** Many automatic levels rely on a pendulum hung from a gimbal. Similar to wire suspended compensators, this method uses gravity to level the device quickly. These devices may come with a manually activated lock to prevent its internal mechanism from being damaged while moving around since it relies on a friction-free bearing for measuring. Other devices come with rubber padding inside to protect the level.
- **Electronic:** Most modern lasers feature electronic leveling capabilities that can automatically produce a horizontal or vertical level. Similar to the pendulum on a gimbal mechanism, the difference lies in the mounted pendulum that features an electric sensor and motors to carefully position the pendulum. This mechanism is the most resistant to bumps and drops. However, they may not be as quick at leveling then its counterparts.



Reason why there is need for technical advancement in construction industry in order to make it sustainable:

With advancement of modernization and technicalization, various new technologies have emerged and expanded and the reasons behind this are as follows.

- *Continuous changing in client expectation:*

With changing market and rapidly changing technology in other industries like automobile, IT, communication due to which the clients are expecting the innovative homes, commercial spaces which has given rise to modular technology.

- *Powerful Software's and IT:*

With the advancement in software made for 3D modelling software, hologram technology using in conjunction with hardware like high resolution camera, drones, lasers taking measurements, generating 3D view of any structures has been possible also by using software's the architects, contractors can make the virtual structure for presentation before client.

- *Tech savvy Techies and Architects:*

As any other industry the construction industry is also resistance to change but the new generation techies and architects being tech-savviness helps them in adopting digital tools, new technologies and they are not only using them but giving feedback for development of new technologies.

- *Supportive Legal Frameworks:*

Government rules and regulations support and promote the use of new alternate building material under the green building initiative saving the environment by innovating the material which can be readily use reducing wastages and minimizing time for construction. Due to above reasons below mentioned are the emerging trends in construction industry:

5. Discussion

A] Emerging Trends in Construction Industry:

As the economy continues to drive growth, construction firms are beginning to master new digital trends that are shaking up the industry. With increasingly scarce resources there is a necessity to create more with less and construction industry will need to operate more efficiently and focus on sustainability. Few of the emerging trends in construction are mentioned below.

- Building Information Modelling (BIM):* BIM is a process incorporating digital representations of the physical and functional aspects of a building that can lead to better collaboration during design and construction on projects. BIM helps contractors, architects and all other agencies involved in the project in early clash detection if any which helps in reducing wastages, reworks and proper planning and scheduling of project.
- Virtual Reality (VR):* VR is mostly used in conjunction with BIM to have better understanding of the complex projects even before it is started at actual. VR allows the owners to see how will their project actually look by having a virtual walk through around the project, the designer can the unseen hurdles and flaws in design before the project is commenced and rectify it early.
- 3D Printing:* 3D Printing is the technology which allows the complicated structures and sections to be prefabricate at the factory and move it to the site which helps in reducing the time drastically also it can be printed on site which reduces material wastages, cost and time.
- Drones:* Unmanned aerial vehicle known as Drones are popularly used in mega projects to inspect the work in progress, to take the measurements, to inspect the safety and to detect the accident which use to take weeks early is now just a matter of hours.
- Advance Uses of GPS:* GPS was used before in construction site to just locate the site now it is used more productively, GPS is used to gather all geographical data of the prospective site also the site connectivity and locality can be studied using the GPS technology, also GPS is widely used to track the position of construction equipment in real time.
- Autonomous vehicles:* Autonomous vehicles mostly the construction equipment's like excavator are programmed in such a way which can achieve the desired level as per requirement also autonomous vehicles are used to do the movement of material on predetermined path.
- Artificial Intelligence:* Artificial Intelligence in conjunction with BIM, GPS, Wearables, Drones, laser scanner gather information, AI is programmed in such a way that the data collected from various sources is gathered and processed whose outcome is used to streamline the process, identify the potential safety hazards and improve it. Construction project planning and scheduling is one area where AI can really shine, simulating the projects millions of times in a matter of minutes and making small adjustments each time to deliver the ideal schedule to maximize efficiency and productivity to reduce timelines and save money. AI is powering

construction robots and drones to monitor jobsite progress and deliver real-time, actionable data to improve jobsite productivity.

B] Technological Trends in Residential Construction Industry in Pune:

The latest technologies and trends discussed above are few of the technologies which are being used by many construction companies, contractors around the world and mostly this technologies are used in developed nation for their mega projects due to availability of IT network, advance hardware's, continuous R & D in material and making breakthrough innovations, development of new process and validating it and also availability of human resource trained for operating and interpreting the data gather from the software's. But when we talk about the residential construction industry in Pune the penetration of technology is very less, Residential construction industry in Pune does not only have to meet the requirements but also has to fulfil the required quality and parameters. Adopting new technology and methods in construction industry has become very crucial as the traditional methods just cannot speed and meet the quality requirements of the current situation. The construction industry as already mentioned is labour intensive industry and is mainly dependant on the skill of the labour in order to meet the quality requirements of the project and it is very difficult to achieve as the labours are seasonal labours and doesn't acquire the necessary skill to perform the work.

Relationship between Auto Levelling Laser (ALL) and Brick masonry:

The Auto Levelling Laser is new generation laser level for the construction & engineering industry. The instrument is ideal for level & plumb, layout and positioning applications and with a high accuracy of 2mm. Crossline laser comes in various models by different manufacturers.

One of the use of Auto Levelling Laser which I am projecting for Brick Masonry is

Brick Masonry Plumb and Level:

Brick Masonry is the most time consuming work in residential building and is also most tedious as the quality and finish of the structure mostly dependant on it, if the mason performing the work is not skilled it further gives rise to complication in external plaster, internal plaster and even it results in affecting the measurement of rooms also many times it leads to rework which results in affecting the schedule and budget of the project. By using the crossline laser the mason can perform the work speedily, with required specifications and with minimal skill as the laser does most of the work of levelling and Plumb, tremendous amount of time is saved as the mason does not required to hold the level line for each layer of the brick and also he doesn't have to check the plumb, also the crossline laser helps in getting perfect 90 degrees in laying the bricks.

6. Data Analysis:

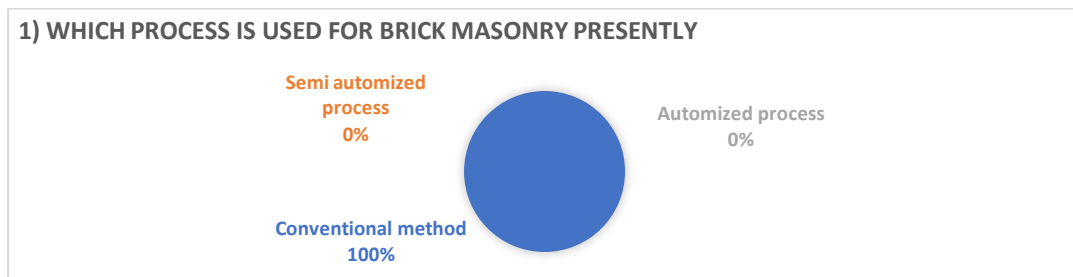
The table below contains the details of the respondents. The respondents belong to residential construction industry whose construction sites are going on in Ravet, PCMC area of Pune.

Sr. No.	Name of the Respondent	Contact no	Name of the Company	Designation in Company
1	Ganesh B Pathare	9689916675	Gauri Lively Spaces	Partner

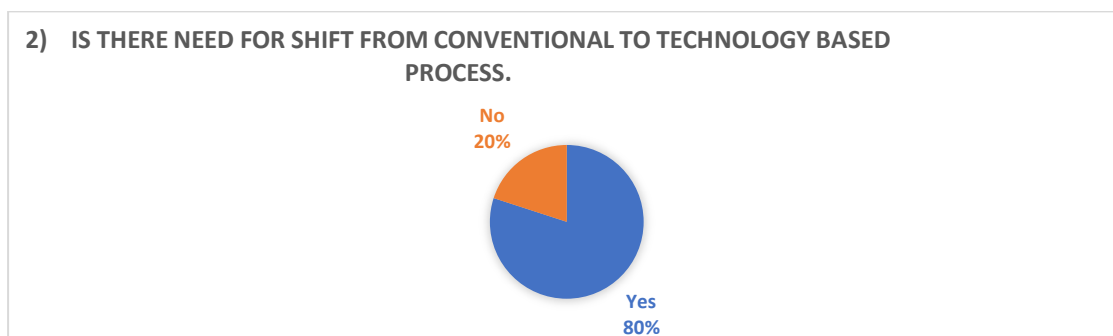
2	Nilesh Mali	8975765929	Nitya Niwas Developers	Owner
3	Nilesh Mangrule	8530640909	Varad Vinayak Developers	Owner
4	Ajit Shelke	9822695182	Samarth Developers	Owner
5	Santosh Khilare	9921624430	Sai Construction	Contractor
6	Jotish Choudhary	9522473749	Bhoomi Infra	Supervisor
7	Sachin Sir	8308551551	Shree Sai Developers	Partner
8	Prafulla Badhe	8308824018	Badhe Builders	Owner
9	Yash Bokephode	9552899022	DSU Builders	Owner
10	Gopinath Dhanne	9922983029	Shriram Construction	Contractor

Following is the analysis of the research information as provided by the respondents in the research questionnaire, the questionnaire was get filled in two parts

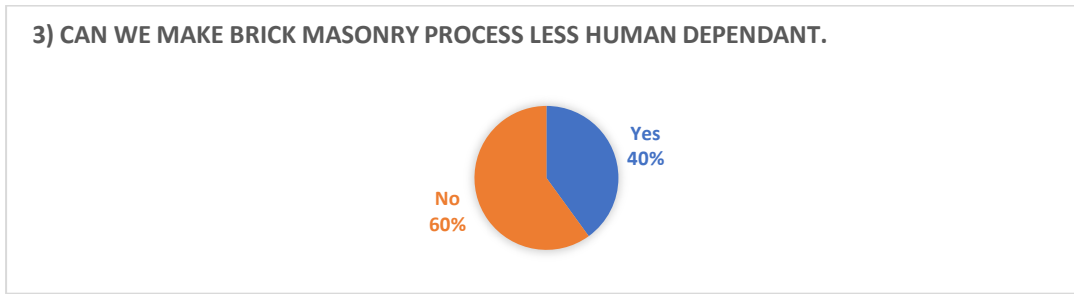
- 1) In first part the respondents were asked about the current process.
- 2) In the second part the questionnaire was presented after giving information and showing the videos of Auto Levelling Laser.



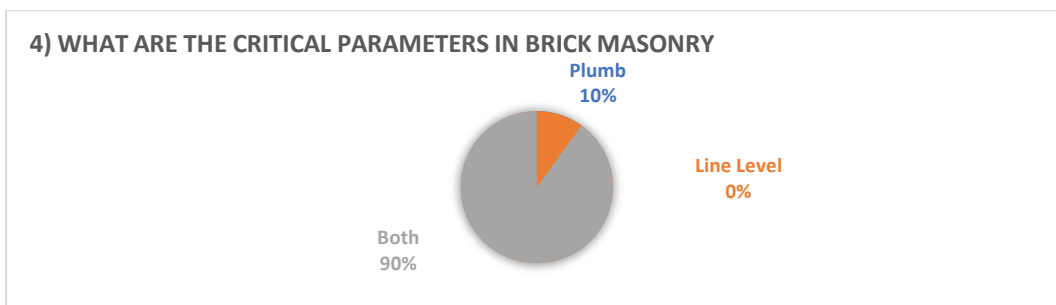
From above it is clear that the process followed at the construction site is the conventional method whose quality and the output is mainly dependant on the skill of the mason.



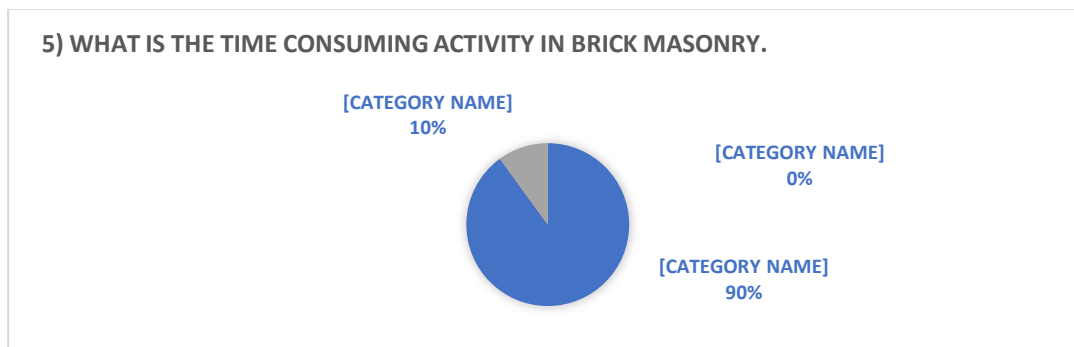
From above figure it is clear that 80% of selected respondent are willing that there should be change in the conventional process followed for Brick Masonry as the process is mostly human dependant.



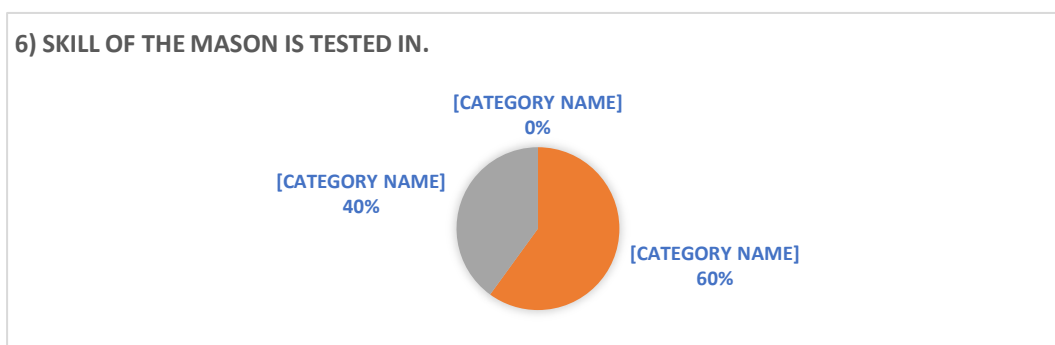
The above Pie chart shows that the 60% of the respondent says that it is not possible to make the procedure less human dependant based on their current knowledge about the process, while 40% of the respondent says that the process can be made less human dependant.



From the above chart it can be said that the critical parameter in Brick Masonry are both Plumb and Line Level, in order to make the process flawless one should concentrate on these parameters.

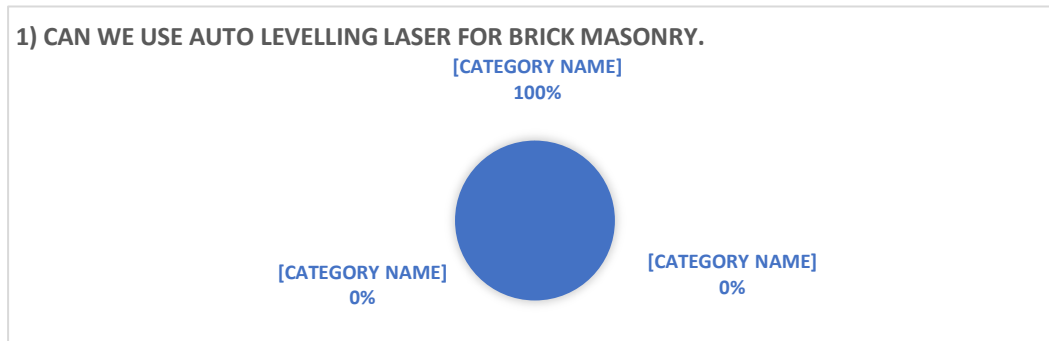


The above pie-chart shows that the 90% of the respondent says that most of the time of mason is consumed in doing the plumb as the external factors like wind, height of the wall to construct affect the accuracy of the plumb bob.

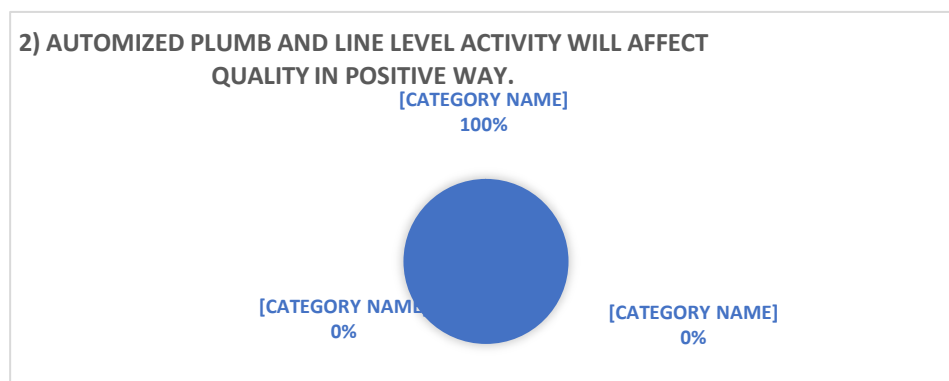


The Pie chart shows that the 60% of the respondent believes that the skilled mason is the one who can construct the wall in proper plumb and in line level, while the remaining 40% respondent say that the skilled mason should also know to properly lay the bricks with uniform mortar thickness in between.

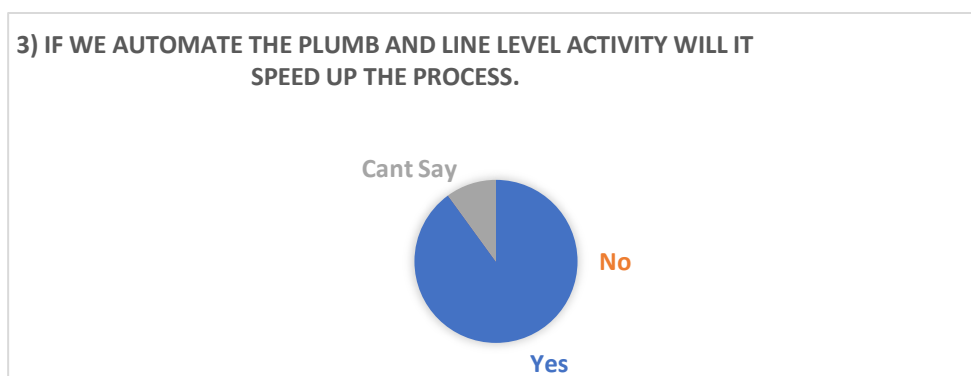
Next set of the questionnaire was given to the respondent after giving information and showing videos about the Auto Levelling Laser



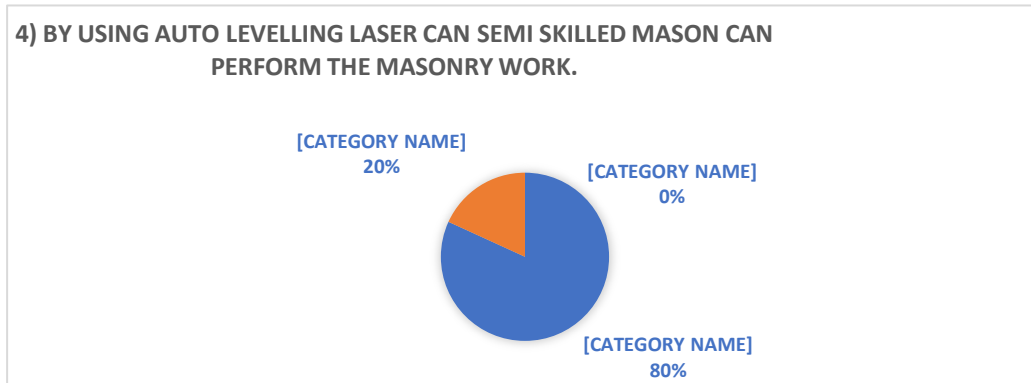
The above Pie chart shows that 100% of the respondent after giving information and conveying the uses of the Auto Laser Level across varied application believes that Auto Laser Level can be used for Brick Masonry.



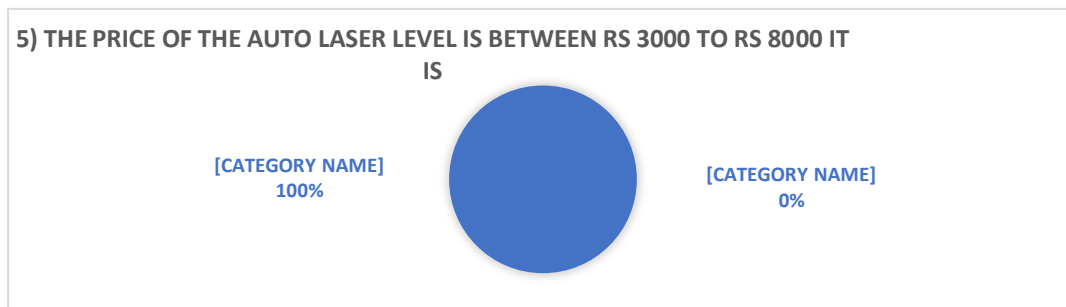
The quality will be affected in a positive way because this is the process which has been automatized with the Auto Levelling Laser and the human dependability for this work is removed so all the respondent says no human interference will improve the quality.



From above chart it is clear that 90% of the population believes that if the mason does not require to do Plumb and line level at every course will definitely save more than 2 to 3 minutes at each course which can be utilized for brick masonry.

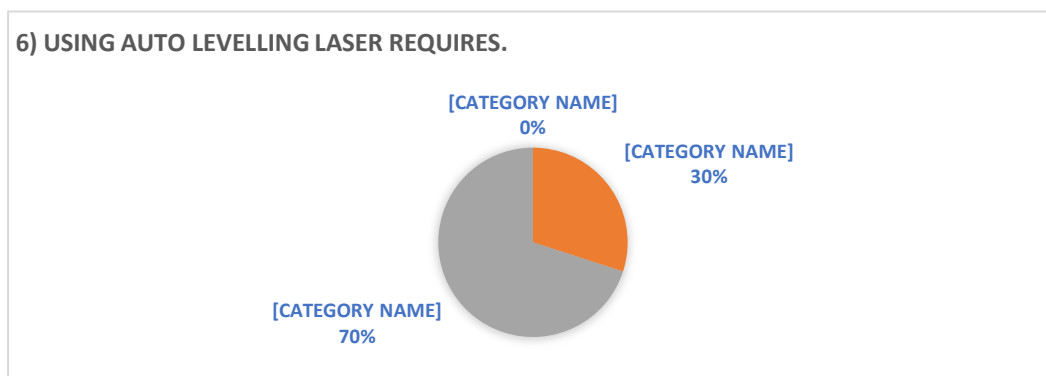


The above chart shows that 80% of the respondent says that the if the plumb and the line level is done automatically even the Semi skilled Labour can perform the Brick masonry work.



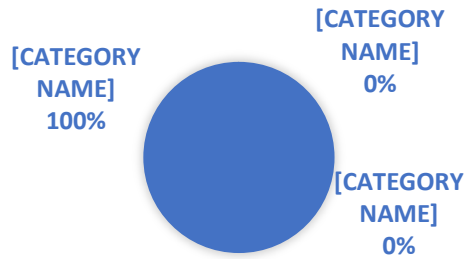
respondent agree that the benefits of the Auto Laser Level is justified against the price of it.

From above chart it is clear that all the



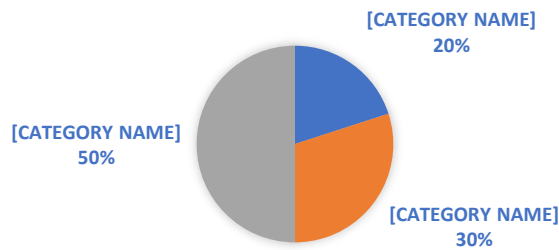
The above pie-chart shows that according to 70% of the respondent the Auto Laser Level can be used with normal training without guidance while for 30 % of the respondent normal training with guidance will be required.

7) OPERATING AUTO LEVELLING LASER IS.



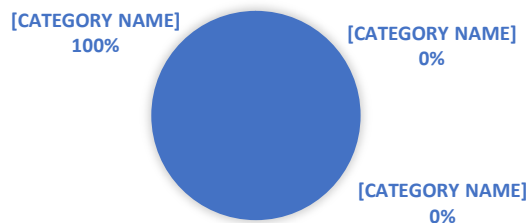
The above pie-chart clears 100% of the respondent believes that after training given operating of the Auto Laser Level is quite easy and can be used by contractors, mason and all other relevant persons.

8) SET UP OF AUTO LEVELLING LASER IS.



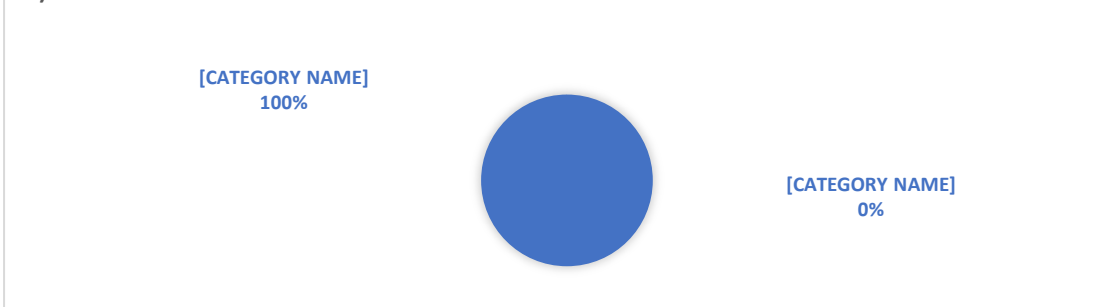
The above pie- chart clarifies that the opinion for above question is varied 50% of the respondent says setup is difficult, 30% says it is moderate while 20 % says that it is easy, in order to make the setup easy so that all can setup the Auto Laser Level with ease customized brackets for holding can be made with interchangeability.

9) WILL YOU SUGGEST THE CONTRACTORS TO USE THE AUTO LEVELLING LASER.



From above pie-chart it is clear that 100% of the respondent are willing to suggest the contractors to use the Auto Laser Level for brick masonry.

10) NUMBER OF TIMES AUTO LEVELLING LASER CAN BE USED .



The above pie- chart shows that 100% of the respondent says that the same Auto Laser Level being digital tool can be used repeatedly for other projects if one gets over and the rotation can go on.

7. Conclusion:

In this Paper, we have tried to look into various factors in which selection of technologically advanced tools for achieving the following targets are figured out:

- The basic skill required by the mason is that he should be able to do the plumb, line level which are the critical parameters in brick masonry and should be able to lay the bricks with minimum uniform thickness mortar.
- Reducing the cost of project by speeding the activity and improving quality by reducing the down time as getting the quality check through plumb bob and line thread is removed which is replaced by Auto Levelling Laser.
- “Kill the Skill” here by using the technology even a semi-skilled labour can perform the activity without compromising the quality and speed of project.
- Also designing the customized brackets for setting up Auto Levelling Laser will help everyone to set up the device also reducing the setup time.
- Same technology can be used for various projects which justifies initial cost of technology, equipment’s.
- Above factors are not only making the use of Auto Levelling Laser in brick masonry innovative but also sustainable because of all the benefits it passes to the mason in the process and its flawlessness in working.

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