e-ISSN:2582 - 7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 5, Issue 5, May 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 5.928

9710 583 466 9710 583 466 ijmrset@gmail.com www.ijmrset.com

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

Drainage Construction Management Using Quality Function Deployment

Bharate Akshay Namdeo, Tandale S.C.

M.E. Student, Department of Civil Engineering, Trinity Academy of Engineering, Pune, India

Associate Professor, Department of Civil Engineering, Trinity Academy of Engineering, Pune, India

ABSTRACT: drainage is the system of pipes underground of sometimes at ground in the form of open drainage line to carry the waste water from household, industries etc.now a day in large cities where a big population lives we cannot adopt the drainage at ground. We have to construct a underground pipe network. For the proper working f this underground network we have to construct this system in perfect manner so that it will serve the respective city for the design period of time without the poundage of waste water and contamination of the water supply line.so to achieve this and reduce the expenditures of lying the drainage pipe line we adopt the quality function deployment.

The growing population of India has created many problems one of the challenging problems is drainage.Maintaina drainage line for the clear passage of water is a very important task in the manner of a civil engineering to avoid the poundage of water on road, footpaths and subways for hustle free movement of human and vehicular traffic. To maintain these civil engineers need to construct the proper drainage line to avoid the blockage and free flow of sewage and rain water towards the water treatment plant and towards the outflow of basin which is basically a river. To perform those task Quality Function Deployment is a very important tool, which is very helpful in reducing the time and money required to perform a task. Quality Function Deployment is a very powerful tool which requires co-ordination and co-operation in working staff on site to be a very effective method of construction and management of drainage in any city.

Some of the studies have done on the Quality Function Deployment in different construction works around the globe; there are many successful stories of the quality function deployment in the construction industry. So it will be very interesting to see how it works in the construction of the drainage.

KEYWORDS: Drainage system, Drainage problems, Demand and supply, Cost of the work, QFD process.

I. INTRODUCTION

1.1DRAINAGESYSTEM

Over the years there has been a continuous migration of people from rural and semi urban areas to cities and town. The proportion of population residing in urban areas has increase from 27.8% in 2001 to 31.2% in 2011 and 40% in 2017. The number of town has increase from 5161 in 2001 to 7935 in 2011, 1055 in 2017. Good drainage systems quickly remove excess surface and sub-surface water from the paddock. An effective drainage system will remove excess soil water within 24 hours of the rainfall event. A good time to assess the needs on your farm is after a heavy rain event when problems with pounding and runoff are easy to see.

There are a number of options available to improve drainage.

Managing water on the right of way requires a drainage system that effectively responds to the immediate environment. A typical highway drainage system includes conveyances of all types: gutters, drains, ditches, culverts, storm sewers, and other miscellaneous drainage structures.

The system is designed and constructed to collect, treat, and remove storm water from the highway right of way. It must be properly maintained to:

- Permit the maximum Use of the roadway.
- Prevent damage to the highway structure.
- Protect abutting property from physical damage.
- Comply with applicable storm water management permits.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

Deficiencies should be corrected when they are discovered. Additional inspections may be required during heavy storms and periods of high runoff in order to determine the effectiveness of the system. High water marks should be observed and recorded as well as conditions that threaten damage to the drainage facility or the highway. Maintenance personnel must be continually alert to assure that all natural water course channels crossing the right of way remain open. WSDOT policy regarding accommodation of Storm water Runoff onto Right of Way is outlined in Policy Statement Number P 2032 dated February 10, 2012. This policy clarifies the department's responsibility for establishing and maintaining storm water management systems for its highways and other facilities that adequately manage the volumes and quality of storm water according to standards contained within the Highway Runoff.

1.2 OBJECTIVES

1. To Study the solution of drainage issues in road drainage through the observation and basic study of QFD approach.
2. To study observations and reviews, this report would conclude the solutions for existing drainage problems.
3. To investigate work on supply and demand of water, blockage prevention, type of flowing material study.
4. To study QFD approach, to achieve optimal solution and to save cost and time.

1.3 MOTIVATION

A drainage system will include all the components needed to ensure that the substructure is properly drained, and may be formed of components such as open ditches, closed ditches with pipe drains and drainage through storm water drainage pipes, channels and culverts. Where there are changes in the terrain or water flow (e.g. where streams are diverted), the drainage system must be planned with particular care. Overloading can result in major damage in the form of erosion and landslides.

1.4 PROBLEMS CAUSED BY POOR DRAINAGE

Poor drainage creates many problems to both road users and road owners. Typically these are:

1.4.1 Traffic safety (aquaplaning and ice)

Poor drainage is a traffic safety risk. Water may accumulate on the road like ponds. The accumulated water creates a risk of aquaplaning during rain. A wet surface reduces friction which leads to longer braking distances. Surface water can freeze during the night at those times of the year with frost nights, and thaw again when temperatures rise above freezing during the day. Where this happens roads may become very slippery and the change in friction may come as a surprise to those who are driving.

1.4.2 Erosion-

Uncontrolled water flows on the road area can cause erosion. Culverts are also risk places for erosion. Small diameter and clogged culverts can cause water to flow towards the road and produce erosion. Water exiting from culverts can similarly cause erosion when it discharges directly on to erosive soil. The sensitive soil types for erosion are silt, silty moraine and sand. Vegetation can reduce erosion.

II. RELATED WORK

2.1 Datta, K.K., T. Laxmi, and P.K. Joshi. 2014. Impact of subsurface drainage on improvement of crop production and farm income in north-west US. Irrigation and Drainage Systems. 18:43-55.

The USA Council of Agricultural research has given priority to control and manage salinity problems that have developed in north-west US. Multi-disciplinary taskforces have recommended installation of subsurface drainage for salinity control, based on design and management techniques developed by the Central Soil Salinity Research Institute (CSSRI), to rehabilitate lands with excess soil salinity. After small-scale studies, large-scale pilot projects were launched to install subsurface drainage in problem areas. One such attempt in was initiated in the north-west region of US where a large-scale drainage project was carried out with Dutch collaboration. We assessed the impact of investments in subsurface drainage in order to validate past funding on research of drainage in US. The important methods Usedfor assessing the efficiency benefits of drainage investment were: to determine the impact of subsurface drainage in terms of net present value, internal rate of returns, consumers' surplus, and producers' surplus;

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

to assess the social welfare in terms of social equality and sustainability of the drainage system; and to examine the factors affecting the sustainability of the technology.

The internal rate of return was computed to assess the efficiency parameter of subsurface drainage for salinity management. In order to measure the changes in inequality distribution of income, Gina concentration ratios were computed with and without installing subsurface drainage. The Radar Approach, a method based on a graphical display of differences between actual ideal performances, was used to quantify drainage sustainability in terms of optimizing gains and conserving, or improving the quality of soil and water resources. There were several farm-level benefits as a result of installing subsurface drainage: these included: (i) a substantial increase in farm income; (ii) cropping intensification and diversification toward high value crops; and (iii) generation of employment. A high internal rate of return justified investment in subsurface drainage. Income inequalities across farms were reduced. The radar approach showed improvement in sustainability in terms of economic gains and resource conservation. Despite these economic, social, and environmental benefits, the sustainability of subsurface drainage technology is questionable. The specific reasons include: (i) the nature of the technology; (ii) lukewarm collective action by the beneficiaries; (iii) conflicting objectives among beneficiaries; and (iv) growing numbers of free riders. To a large extent these were addressed in the study area by forming village committees. Without appropriate institutional arrangements, subsurface drainage may not yield the desired results, and in the long run may result in neglect of operation and maintenance needs and ultimately the abandonment of the technology.

2.2Baker, D. B., P. R. Richards, T. T. LoftUS, and J. W. Kramer. 2014. A New Flashiness index: Characteristics and Applications to Midwestern Rivers and Streams. Report No. 03095 of the Journal of the American Water Resources Association (JAWRA) (Copyright © 2014), pp 503-522.

The term flashiness reflects the frequency and rapidity of short term changes in stream flow, especially during runoff events. Flashiness is an important component of a stream's hydrologic regime. A variety of land use and land management changes may lead to increased or decreased flashiness, often to the detriment of aquatic life. This report presents a newly developed flashiness index, which is based on mean daily flows. The index is calculated by dividing the path length of flow oscillations for a time interval (i.e., the sum of the absolute values of day-to-day changes in mean daily flow) by total discharge during that time interval. This index has low internal variability, relative to most flow regime indicators, and thus greater power to detect trends. Index values were calculated for 515 Midwestern streams for the 27-year period from 1975 through 2001. Statistically significant increases were present in 22 percent of the streams, primarily in the eastern portion of the study area, while decreases were present in 9 percent, primarily in the western portion. Index values tend to decrease with increasing watershed area and with increasing unit area ground water inputs. Area compensated index values often shift at eco region boundaries. Potential index applications include evaluation of programs to restore more natural flow regimes.

2.3Jin, C.X., G.R. Sands, H.J. Kandel, J.H. Wiersma, and B.J. Hansen. 2008. Influence of subsurface drainage on soil temperature in a cold climate. Journal of Irrigation and Drainage Engineering. 34(1):83-88.

Soil temperature during springtime is an important factor for crop establishment and growth in poorly drained soils of northwest Minnesota. In this region, shallow water tables causing spring planting delays and excess water conditions during the growing season, may have contributed to significant unplanted cropland and yield reductions in recent years. Temperature is a regulating factor for many biological and chemical processes in the soil. One of the most commonly cited benefits of subsurface drainage on poorly drained soils is faster soil warm-up in the spring. Previous studies of this phenomenon do not provide definitive conclusions concerning the influence of soil 8 drainage on soil temperature. The results of three site years of field observations of soil temperatures from drainage research plots at two locations in northwest Minnesota are presented herein. Replicated soil temperature and water table depths were measured continuously at five depths for two drain spacing's and an untrained treatment. Subsurface drainage was found to significantly increase soil temperatures in both a coarser textured *Vallers*loam soil and a finer textured *Hegne*silty clay loam soil. Up to 4°C temperature increases occurred primarily between May and July with the greatest increases at 30 — 60 cm depths. Treatments with narrow drainage spacing showed a greater spring temperature increase than treatments with wider drainage spacing's.

III. METHODOLOGY

3.1 QFD System

One of the most important characteristics of a product is that the customer likes it. A customer likes a product when it fulfills his needs and meets the requirements he expected from the product. Therefore a lot of technologies in the field of management, organization and manufacturing have been developed and proved to work for product development and

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

improvement. In this report an introduction is given to the management tool QFD, which is a 'proven' approach for translating costumer needs into design solutions for road drainage.

3.2 QFD PROCESS

Two popular models illustrate the QFD process. One is the four phase model developed by Mouser and causing (1988). This is probably the most widely described and used. The other is by Dr,Akao (1990) called the "matrix of Matrices."Akao's model is considered gigantic and far reaching (Cohen, 1995). The QFD structure is normally presented as a system of matrices, charts, tables, or other diagrams. The four phase model seems to be more common in the QFD application, so it is briefly described here. The fourPhase model is based on the following key documents or components:

1. Overall customer requirement planning matrix-translates the general customer requirements into Specified final product control characteristics for road drainage.
2. Final product characteristic development matrix-translates the output of the planning matrix into critical components characteristics for road drainage.
3. Process plan and quality control charts-identify critical product and process parameters and develop Checkpoints and controls for these parameters.
4. Operating instructions-identify operation to be performed by plant personnel to ensure that important parameters are achieved.

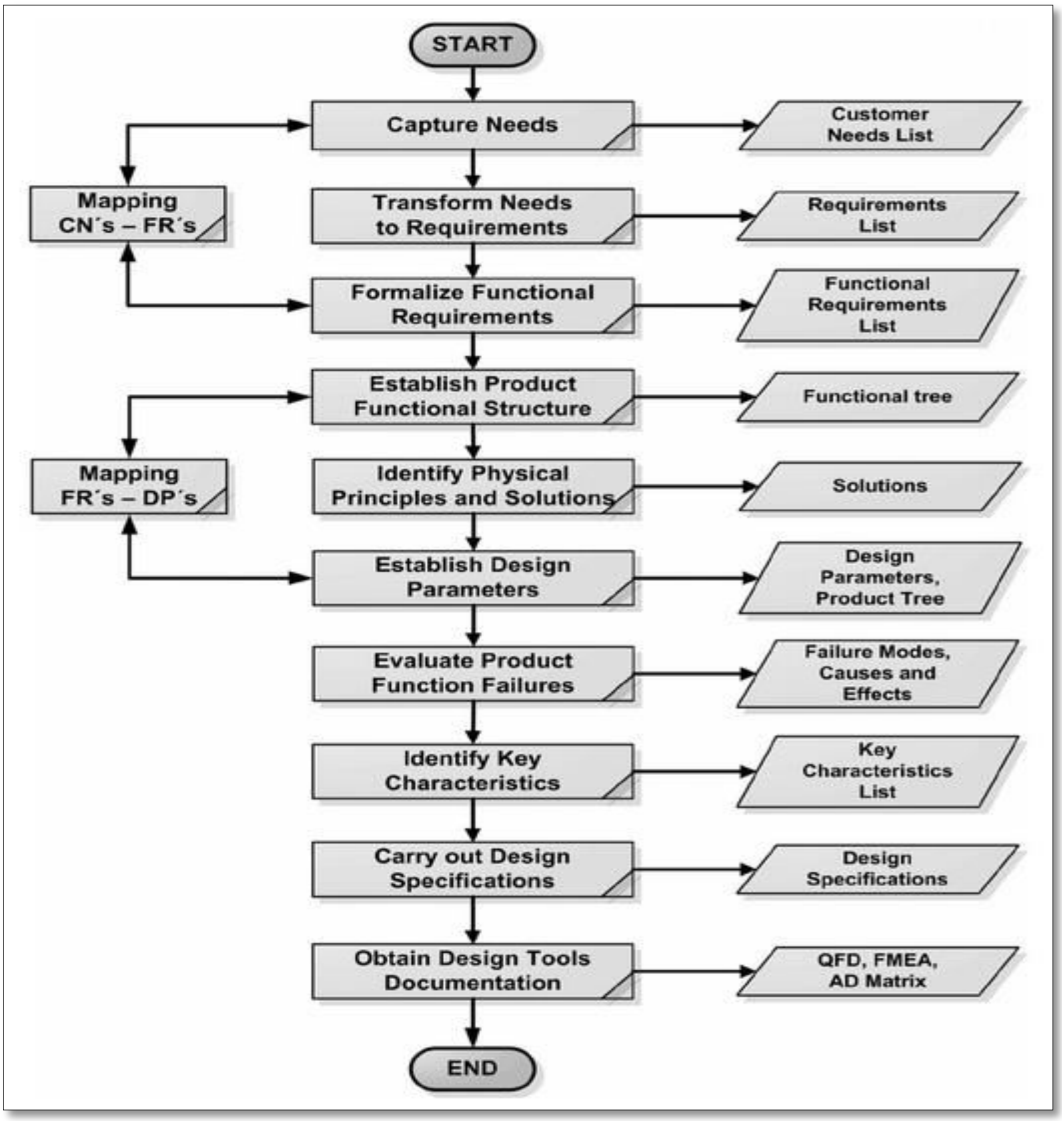

Fig.1: Quality Function Deployment flow

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

IV. EXPIRIMENTAL RESULTS

4.1 DEMAND AND SUPPLY DATA

For Population of 20,000 People by considering 150 LPCD consumption.
20,000*150 lit= 30, 00, 000= 3MLD
30, 000, 00*0.85
Sewage =2.55MLD

4.2 TOTAL COST OF WORK

10,000 to 12,000 Rupees per meter to lay down the drainage line of 600 m along with connection and manholes.
12000*600 = 72 lacks

COST SHEET LABOUR AND MAINTENANCE

TECHNICAL INDEX	BEFORE QFD	AFTER QFD	IMPROVEMENT
Labor Cost	Rs 3,75,000 Lakhs 5 Labor Per day Charge- Rs 500 Total days- 150 QFD NOT USED	Rs 2,25000 Lakhs 3 Labor Per day Charge- Rs 500 Total days- 150 QFD USED	20% Cost Saving
Maintenance Cost	Rs 30,000 **1.DrainageLeakage-** 8000 for 4 People for 4 days. **2.Pipes Cuts Recovery-** 10000 for 5 People for 4 days. **3.Cleaning and Oiling-** Rs 12000 for 6 people for 4 days.	Rs 16,000 **1.DrainageLeakage-** 4000 for 2 People for 4 days. **2.PipesCuts Recovery-** 6000 for 3 People for 4 days. **3.Cleaning and Oiling-** Rs 6000 for 3 people for 4 days.	80%

Table no 6.1: Cost sheet and labor sheet

Before QFD

- Labor cost: 500 X 5 = 2500 INR
- Days : 150
- Labor cost * Days : 150 X 2500 = 375000 INR

After QFD

- Labor cost : 500 X 3 = 1500 INR
- Days : 150

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 5, May 2022 |

|DOI:10.15680/IJMRSET.2022.0505013 |

- Labor cost * days : 150 X 1500 = 225000 INR

V. CONCLUSION

By using QFD approach we can create revolution in drainage system management. By using this technique we can save time & Cost and this system is long lasting in comparison to conventional method. Long term planning is done before applying this system. This system is beneficial for both urban and rural areas. All drainage related problems can be easily solved using this technique. From the consideration of all the above points we conclude that our research is to find the solution of drainage issues in road drainage through the observation and study of QFD approach. Firstly, we investigate the existing road drainage and summarize the design methodology from our previous researches. Through the observations and reviews, this report would conclude the solutions for existing drainage problems. We work on supply and demand of water, blockage prevention, type of flowing material study. By using QFD approach we get optimal solution and to save cost and time. QFD approach is better for saving time and cost.

REFERENCES

[1] Abdel yam, S., A. J. Hoevenaars, P. P. Mollinga, W. Scheumann, R. Slootweg, and F. VandSteengergen. 2005. *Agricultural drainage: Towards an integrated approach*. Irrigation and Drainage Systems (2015)

[2] Ale, S., L.C. Bowling, J.R. Frankenberg, S.M. Brouder, and E. J. Kladivko. 2010. *Climate variability and drain spacing influence on drainage water management system operation.* Vadose Zone Journal. 9(1):43-52.

[3] Akao,y.,(Ed.), Quality Function Deployment, Integrating Customer Requirements into Product Design, Productivity Press, Cambridge, MA, 1990

[4] Abdul-Rahman, H., Kwan, C.L., Woods, P.C. (1999), Quality Function Deployment in Construction Design: Application in Low-cost Housing Design, International Journal of Quality & Reliability Management, Vol. 16 No. 6, pp. 591-605.

[5] Arditi D, Lee D. (2003), assesses the corporate service quality performance of design-build contractors using quality function deployment. Construction Management and Economics; 21: pp. 175–85.

[6] Baker, D. B., P. R. Richards, T. T. LoftUS, and J. W. Kramer. 2014. A New Flashiness index: Characteristics and Applications to Midwestern Rivers and Streams. Report No. 03095 of the Journal of the American Water Resources Association (JAWRA) (Copyright © 2004), pp 503-522.

[7] Carlier, J. P., C. Kao, and I. Ginzburg. 2013. Field *Scale Modeling of Subsurface Tile Drained Soils Using an Equivalent-Medium Approach*. Journal of Hydrology, Volume 341, Issues 1-2, 20 July 2007, Pages 105-115.

[8] Chan, L.K., and Wu, M.L. (2005). A systematic approach to quality function deployment with a full illustrative example. Omega, 33, 119-139.

[9] Datta, K.K., T. Laxmi, and P.K. Joshi. 2014. Impact of subsurface drainage on improvement of crop production and farm income in north-west US. Irrigation and Drainage Systems. 18:43-55.

[10] Etherington, J.R. 1984. Comparative studies of plant growth and distribution in relation to waterlogging. J. of Ecol. 72:389-404.

[11] Jin, C.X., G.R. Sands, H.J. Kandel, J.H. Wiersma, and B.J. Hansen. 2008. *Influence of subsurface drainage on soil temperature in a cold climate.* Journal of Irrigation and Drainage Engineering. 34(1):83-88.

[12] Roy.B.Hunter；BMS 79 Water Distributing System for Building, （1941）

INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 5.928

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

9710 583 466

9710 583 466

ijmrset@gmail.com

www.ijmrset.com