iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** X **Month of publication:** October 2023

DOI: https://doi.org/10.22214/ijraset.2023.56250

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue X Oct 2023- Available at www.ijraset.com

A Research Paper on Study of Hydraulic Bridge

Prof. M..P.Chavhan[1], Bhagyashree G. Gaydhane[2], Neha R. Gore[3], Pranita Rathod[4], Fatim Shaikh[5], Mohhamad Soban[6]
Department of Civil Engineering, Jagadambha College of Engineering & Technology Yavatmal, Maharashtra, India

Abstract: ***Hydraulically assisted bridge a new concept in bridge design which incorporates an in integrated hydraulic system into the bridge in order to carry more weight. The system is most suitable for arch based bridge in which the main forces are directed in a horizontal sideways direction. Predication of the risk to build in infrastructure posed by climate and land use change have suggested that bridge. collapses may increase due to more frequent or intence flooding. Assessment of the united state often assume that bridges may Collapse when the 100year flood occurs but this Assumption has not been fally tested due to lack of comprensize collapse record 35 bridge. for which a stream gauge 35 bridges for which a stream gauge on or near the bridge recorded. The flow during total or partial collapse were identified and used to test this assumption. Flood frequency analyses, and used to test this assumption. Flood frequency analyses, and statistical analyses, other structural reliability methods. Where used to quantity the return periods of collapse. Indusing flows, identify trends linked to event and site characteristics and evaluate the potential importance of collapse return period variability in assessing the impact of climate and land use charge on hydraulic collapse risk.***

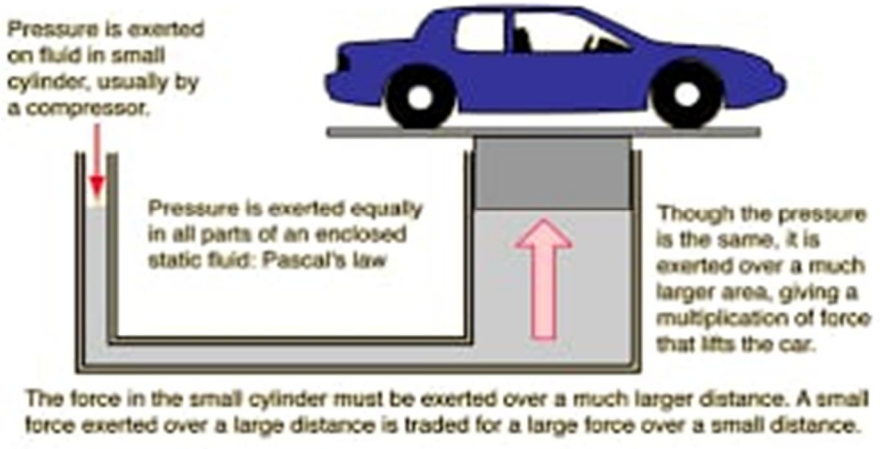
I. INTRODUCTION

The Colorado department of transportation CDOT intends to replace the state highway 96A river in pueblo Colorado ayres associates is a member of design team laid by fig bridge engineer ayres associates and drainage assessment report FDAR for the project in Dec 2001 ayres associates 2001 and submitted in preliminary bridge hydraulic report for the project in may 2003. Ayes associates 2003 in Jan 2006. The design team began the final design of the project ayres associates is performed studies regarding the hydrology, river floodplain hydraulics in supports of the final design effort. This report Document Those studies A bridge which licenses passage of the watercrafts or cargo boats is regularly known as the portable scaffold. Exactly When improvement relies upon the water driven structures then it is delegated water driven a bridge. For building a model Consistently used Pressure driven gear are needles. As the scaffold is on and an opened and shut, weakness disappointment under is the most disturbing element than disappointment under consistent burden. Furthermore, the structure is more perplexing in light of the fast that we can give any balance other then the arch help to allow watercrafts and boats to pass.

The hydraulic bridge is also known as moving bridge. In simply hydraulic bridge is a structure construct over barrier a passage way. Hydraulic bridge is used for allowing boats and ships. London bridge in England and Pamban bridge in Tamilnadu. From 1998 to 2018, 123 bridge disasters by the flood have occurred in China. in Hydraulic bridge works on the principle of pascal's law.

PRINCIPLE OF PASCAL'S LAW

Pascal's law states that when there is increase in pressure at any point confined and incompressible fluid. The pressure is transmitted equally in all directions throughout the fluid.



©IJRASET: All Rights are Reserved

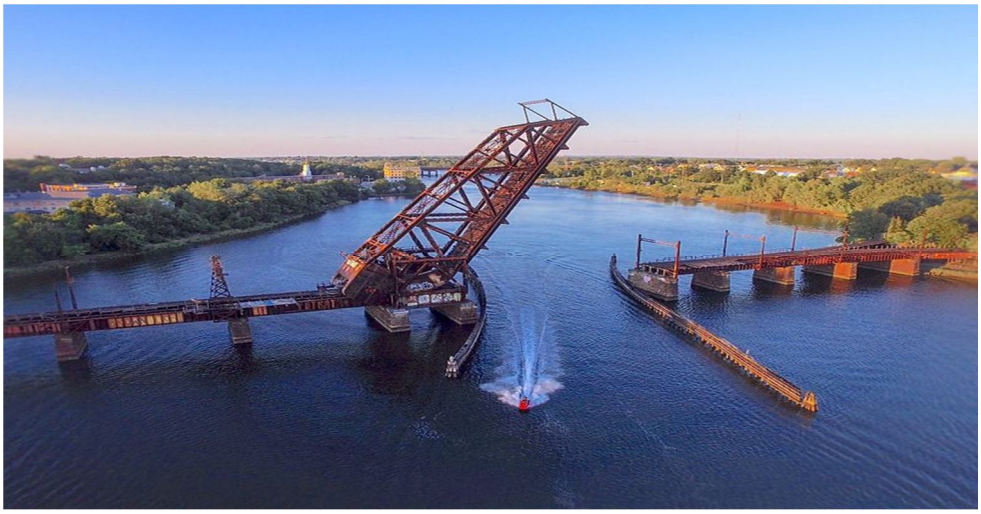
II. OBJECTIVES

1) To study different types of bridges.
2) To aware about bridges failure.
3) To know the Reasons behind failure of bridges.
4) The bridge deck drainage system includes the bridge deck, gutters, raillings, sidewaiks and inlets.
5) The primary objective of drainage system to remove runoff from bridge deck before it collets in gutter to point the exceeds the allowable design spread.

III. TYPES OF HYDRAULIC BRIDGE

A. *Bascule Bridge*

1) The bascule name of comes from French them for Balance scale.
2) The name bascule is come from French word sea- Saw.
3) Bascule bridge built in 1913 in India. Its located Kidderpore Kolkata.
4) It is 120 years old.
5) Bascule bridge commonly use cities and water- Ways.



B. *Lifting Bridge*

1) The bridge was designed by Thomas F.
2) The design life of lifting bridge 100 years.
3) It is suitable to support heavy structure.
4) It consist of platform a roadway supported By counterweight system and can be raised and lowered by mechanical used.
5) Means the lifting mechanism typically involve a Series of cables, pulleys used to lift.



©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

C. Swing Bridge

1) The development of swing bridge in 1797.
2) Longest swing bridge in the world is EI railway bridge in Egypt runs from east of suez canal to west onto sinai.
3) Swing bridge used in waterways.
4) They are typically operated by bridge tender.
5) EX. Drawbridges, vertical-lift bridges.



IV. LITERATURE REVIEW

1) *Study entitled "Design and Fabrication of a Retractable Bridge"* Published by Froylan Noel Cannon Gracias in December 2017: The objective of the project was to design and build a new type of bridge that would retract automatically to give way for ships to pass when movement in the river or canal is picked up by a sensor on the bridge. The idea of the retraction was to bring about an innovative design of bridge structure that couldn't be found easily at some part of the world. The mechanism of the retractable part would be design that would able to support while maintaining balance and position the retractable part in correct order every time it's retracted.

2) *Study entitled "Hydraulic Analysis of Bridge Piers Replacement"* Published by Stasa Vosnjak, Gorazd Novak: Hydraulic analysis of bridge piers construction impacts was carried out on the salzach river in Austria. The construction of a new bridge due to the expansion of the double track railway to three tracks foresees two new bridge piers in addition to the four existing ones. Since it is not possible to interrupt the traffic, a new parallel railway bridge has to be constructed first, and only afterwards the old piers will be removed. Since such a number of bridgepiers will cause the conveyance reduction of the river, hydraulic modeling was demanded and performed at the technical university graz.

3) There are many bridge failures in the world. Bridge failure is the most concerned problem of the engineers (Wesley Cook,Bar.& Halling, 2015; Harik, Shaaban, Gesund , Valli,& Wang , 1990; Rodrigo, Olaria, Fernandez-Ordone, & Gomez. 2015). The consequences of bridge failure can range from unexpected maintenance needs, to the loss of life and economic prosperity. Failure types include hydraulic, collision, overload, deterioration, fire, construction, fatigue, and miscellaneous.

4) The damage caused by foundation scour and settlement from soil erosion is a great threat to bridge structure. Scour is the main cause of bridge failure (Duntemann & Subrizi, 2000; Harik et al., 1990).

5) Wadhana found that flooding or scouring was the main cause of bridge failure in the United States (Wardhana& Hadipriono,2003). Cook estimated an annual hydraulic bridge failure frequency of approximately 1/8500 (W. Cook, Barr, & Halling, 2014).

6) Flint indicated that bridge failures may increase due to more frequent or intense flooding (Madeleine M. flit, Olive Fringe, Sarah L. Billington, David Freyberg,& Diffenbaugh, 2017).

7) Lin selected 45 bridges as a case study to evaluate scour performance using the developed integrated analysis technique (Lin, Bennett, Han, & Parsons, 2012). Hung examined the influence of scour on the behavior of bridge piers subjected to flood-induced loading(Hung & Yau, 2014).

8) Hager investigated the end scour depth due to a single peaked flood wave in an essentially plane rectangular sediment bed containing a single pier for clear-water conditions(Hager &Unger, 2010).

9) Once the foundation without sufficient depth is submerged, it is easy to collapse. Today, climate change and associated extreme weather events are causing more flood-related damage to bridges (Choudhury & Hasnat, 2015; Wardhana & Hadiprino, 2003). Most of the damage are not just caused by water. During the flood period, sediment and other tiny floating objects are easy to deposit in the river channel, which affects the flood discharge and makes the bridge easy to be washed away by water. Large floating objects, such as trees, will directly impact the bridge foundation and damage the pier and river channel.

V. DATA AND METHODOLOGY

Basic principal of bridge design are dependent on load bearing structure concave and convex, flat bridge design determine by height ground condition and clear span type of bridge foundation.

1) *Precast Bridge Construction Method:* Precast bridge divided into three part of beam and super tee, segmental and full span precast construction mean bridge member are prefabricated t location different from site. Transported to site and installed there Construction with precast in place segmental have several advantages in comparison with cast in place segmental bridge. Costing of segment can be perform under control plant like condition at the pre-casting yard.
2) *Cast in – Situ Method of Bridge Construction:* In this method strength concrete as well as high strength material such as wire, bars and steel stands should be used. This method has several advantages namely reducing direct cast and reducing the required material. Labo cost, rebar and transportation costs and increasing the speed of form work.
3) *Span By Span Casting Method Of Bridge Construction:* Span y span erection is most commonly simplest and often most cost-effective construction method precast segmental bridge. It is compatible with simply supported and continuous span in range of 35-55 miter of this construction method.
4) *Incremental Launching Method Of Bridge Construction:* In current application the method highly mechanized and uses prestressed concrete. Bridge are mostly of the box girder design and work with straight or constant curve shapes with constant radius 50-30 miter and 49-98 ft box girder section of bridge deck are fabricated at one bridge in factory condition each section is manufacture in around one weak. The first section of launch, a launching nose is not made of concrete but is a stiffened steel plate girder 60% of length of bridge span.
5) *Cable – Stayed Method Of Bridge Construction:* Cable – stayed bridge method use a form in which the weight of deck supported by a number of nearly straight diagonal cable in more vertical tower. The tower transfer cable forces to foundation through vertical compression.

Our hydraulic bridge base on Balance cantilever bridge. A balance cantilever bridge. When two opposing free cantilever structure are attach single structure and erected in same step know as balance cantilever bridge. the economical range of a span length for cast in- situ cantilever construction begins at 70miter and extend to beyond 250miter considerable saving can be achieve by using this method rather than conventional bridge construction. The advantage of use in this method specially in urban areas refer to characteristic that shoring and itan disrupt traffic over water channels and in deep gorges which is very dangerous for workers.

a) Advantages Of Balance Cantilever Bridge

- Requirement of falsework is not much other than the requirement for the pier.
- Only one side of each cantilever requires support.
- It is less time consuming as multiple cantilever span construction can be stated simultaneously from all its columns.
- Navigation under bridge is not disturbed during construction process
- .The span of cantilever bridges is usually longer than conventional beam since cantilever is attached at the ends of the bridge.
- These bridge are most suitable for flood-prone area and deep rocky valleys where falsework might be dangerous of difficult.

b) Disadvantages Of Balance Cantilever Bridge

- Cantilever bridge requires a heavier structure to take care of its own stability by creating stability between compressive and tensile forces
- .During the construction of cantilever bridges they experience a high level of tension which is known as negative moment.
- Cantilever bridges cannot be constructed in extreme climate condition due to the lack of multiple seasons.
- Disability of the RC floor as part of a composite section.
- Requires bigger and stronger support columns to withstand the bridge load.
- Cantilever beams ae not suitable for earthquake prone areas with low-rock stability.

©IJRASET: All Rights are Reserved

c) Advantages Of Hydraulic Bridge

- Safe and easy to maintain with few moving parts.
- Easy controlled.
- Liquid does not absorb supplied energy.
- Responsive and supplies more power.
- It provides smooth and accurate acceleration and declaration.
- It provides smooth and easy operations.
- It has the ability to carry varying load.
- The operator of hydraulic system can easily start, stop, and slow down.
- It can lock in any position

d) Disadvantages Of Hydraulic Bridge

- Poor resistance to working fluid pollution.
- Sensitive to temperature changes.
- Hidden danger of leakage.
- Difficult manufacturing and high cost.
- Hydraulic oils are petroleum base oils hence there are chances of fire hazards.
- Leakage of oil causes dirty surrounding, slippery floor, increased chances of accidents.

VI. RESULT AND DISCUSSION

The studying these reviews, we concluded that the hydraulic bridges. This paper investigates 123 hydraulic bridge failures. The geographic distribution, age distribution bridge type distribution and time distribution are analyzed. It is found that there are more hydraulic bridge failures in southern China. Sichuan province has the highest number of hydraulic bridge failure. Most bridges have a life span of these bridges is 28.9 years. Hydraulic bridge failures mainly occurred between 2009 and 2014. The beam bridge accounts for the biggest share of hydraulic bridge failures. There are both natural factors and man- made factors, such as unexpected flood, earthquake, old bridge, over sand exploitation, low awareness of hydraulic bridge damage, extreme morphology of the river, etc. finally, the finding of this study are as followings:

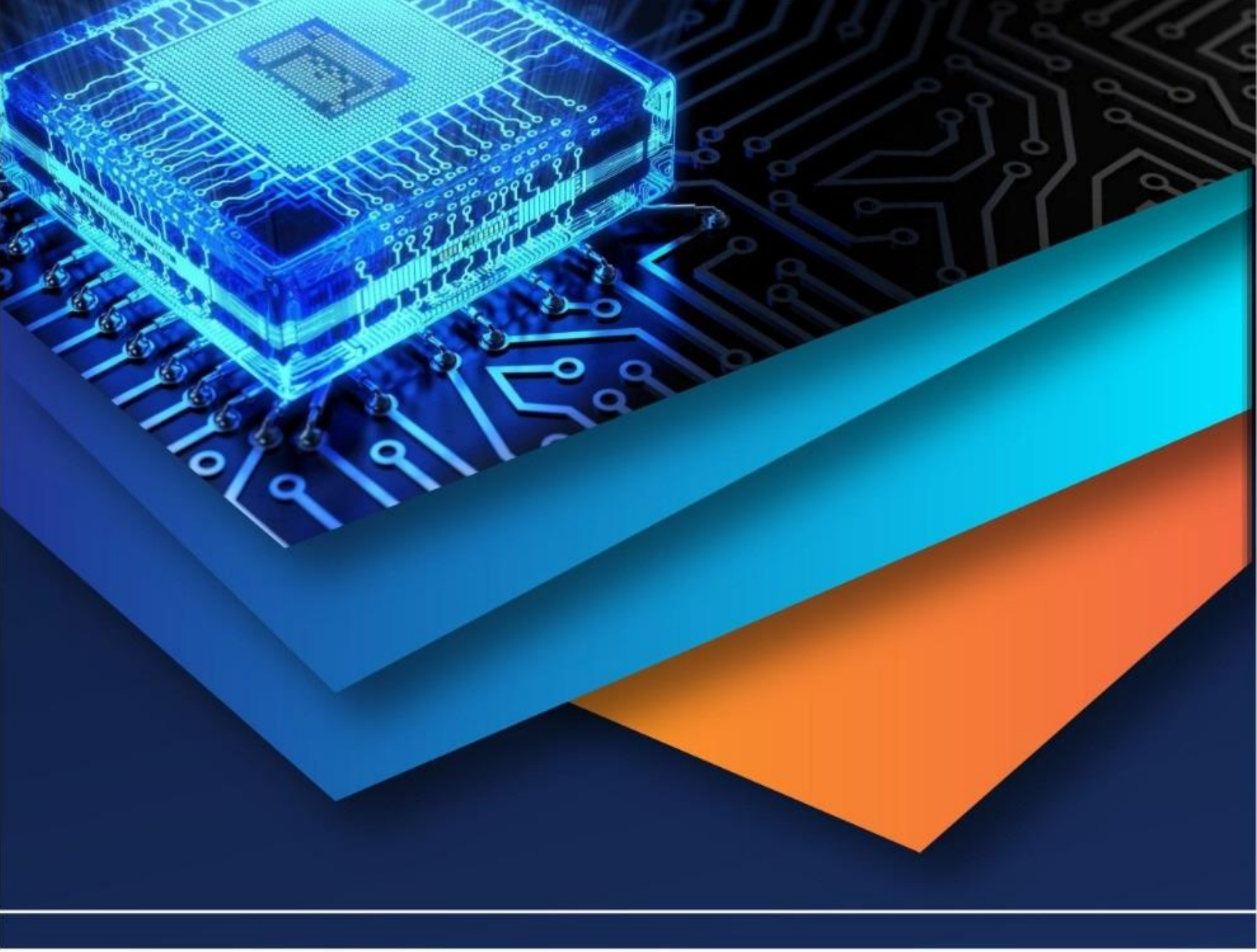
1) Most of the collapses occurred on old bridges. They cannot be assumed to meet modern design standards. Therefore, the bridge design engineer must adequately consider the expected flood.

2) The bridge type with fewer piers should be selected, such as cable- stayed bridge and suspension bridge so as to avoid hydraulic damage. The estimated pier scour depth is not sufficient and doesn't consider all factors responsible for large scour.

3) Before construction of any bridge on river, possible changes in examined, considering all the natural and anthropogenic factors.

REFERENCES

[1] AASHTO. 2017. *AASHTO LRFD bridge design specifications*., Washington, DC: AASHTO.
[2] Abed, L., and M. M. Gasser. 1993. "Model study of local scour downstream bridge piers." In Proc., National Conf. on Hydraulic Engineering, edited by H. W. Shen, S. T. Su, and F. Wen, 1738–1743. Reston, VA: ASCE.
[3] Annandale, G.W., 1999. "Estimation of Bridge Pier Scour Using the Erodibility Index Method" in Stream Stability and Scour at Highway Bridges, ASCE Compendium of Water Resources Engineering Conferences, 1991-1998, edited by Richardson and Lagasse.
[4] Argyroudis, S. A., and S. A. Mitoulis. 2021. "Vulnerability of bridges to individual and multiple hazards-floods and earthquakes." *Reliab. Eng. Syst. Saf.* 210: 107564. https://doi.org/10.1016/j.ress.2021.107564.
[5] ASCE. 2005. *Minimum design loads for buildings and other structures*. New York: ASCE. Crossref.
[6] Avent, R. R., and M. Alawady. 2005. "Bridge scour and substructure deterioration: Case study." *J. Bridge Eng.* 10 (3): 247–254. https://doi.org/10.1061/(ASCE)1084-0702(2005)10:3(247).
[7] Azadbakht, M., and S. C. Yim. 2015. "Simulation and estimation of tsunami loads on bridge superstructures." *J. Waterway, Port, Coastal, Ocean Eng.* 141 (2): 4014031. https://doi.org/10.1061/(ASCE)WW.1943-5460.0000262.
[8] Beltaos, S., L. Miller, B. C. Burrell, and D. Sullivan. 2007. "Hydraulic effects of ice breakup on bridges." *Can. J. Civ. Eng.* 34 (4): 539–548. https://doi.org/10.1139/l06-145.
[9] "Boat", *Wikipedia, 2023-04-09*, retrieved 2023-05-17
[10] ^ "List of road–rail bridges", *Wikipedia, 2023-04-15*, retrieved 2023-05-17.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)