Qualitative control on welding forging and qualitative study on work pieces undergone welding forging

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Abstract : Nowadays, using efficient and effective methods and minimizing the costs in construction operations are of vital importance. All researchers in engineering fields have been trying to introduce some approaches addressing more efficient pathways. In addition, structural engineers have mostly involved with processes by which the respective goals are achievable shortly and efficiently. Using welding forging is widely considered as one the most promising approaches to mitigate the costs of structures. The most distinctive feature of welding forging is that compared to other mentioned methods it diminishes significantly the different wastes arisen from reinforcement occurred during construction, leading to minimizing the costs imposed by reinforcement operations. In this work, some features of this welding method were investigated. In addition, we addressed that whether this method is capable to enhance the standard resistance against earthquake or not.

Keywords: Welding, Civil engineering, Structure, Forging, Fittings.

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1- Introduction

Earthquake is one of the most widespread disasters threatening human and other creatures. Importantly, Iran is located in conjunction area of several faults, so it is threatened by earthquake dangers widely. Therefore, using engineered methods related to fabric of main structures is a crucial mater; however it is important not to apply over-priced techniques. Fittings are usually used to reinforce structures against load resistance and in some cases, it is necessary to connect different fittings. Accordingly, a wide range of conjunctions have been introduced for this purpose. One of these methods is welding forging, which was invented in 1952 and used for rail transportation in Japan. With increased amount of construction works in urban areas and city centers comes rose demands for proper reinforcing using welding forging. In consideration of high order of safety provided by such fittings, it has widely entered the construction industry. In this method, overlapping different fittings has been replaced by a new method in which two ends of fittings is more strongly fitted together by means of exposing controlled heat and pressure (Shirazi, 2015).

1-1- applications and advantages of welding forging of fittings

The welding forging is applicable in different areas as follows:
- Connectivity of fittings used in columns of concrete structures.
- Connectivity of fittings in foundations.
- Connectivity of fittings in basket weaving and candles with different longs and shaped.
- Connectivity of the useless fittings.
- Connectivity of fittings used in shear walls.
- Modification and Connectivity of destroyed bolts.
- Modification and increase of short roots.
- Modification of fittings used in poles (Buts et al., 1979).

In addition, the welding forging enjoys several privileges as listed below:
- Increased resistance in Connectivity zone caused by increased diameter.

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- Saving the amount of needed fittings as much as 30%.
- Reduced error human related to reinforcement and organization of fittings.
- decreased weight of structures because of the elimination of overlap.
- Increased structures' resistance against exterior imposed forces, i.e. earthquake, as a result of decreased structures' weight and gravity.
- Increased quality of concrete and fitting mixing due to decreased fitting's volume.
- Enhanced vibration capability because of decreased fittings' volume.
- Integrated load analysis in conjunction zone.
- Decreased costs related to transportation as a result of reduced consuming materials.
- Capability in creating conjunction with minimized long.
- Maintained metallurgical characteristics of fittings.
- Possibility of fitting different sizes to one another (based on the respective standard).
- Cost and time-effective, leading to preventing operators from time-consuming reinforcement.
- Possibility of reusing some waste and damaged fittings.
- Capability for applying in different positions.
- Needless of using three-phase electric power.
- User friendly and portable by staff (Shirazi, 2015, Seifert and Meiners 1981, Shinozaki et al, 1999, Kazakov, 1985, Fukushima and Hasui, 1973, Buts, 1979, Dunkerton, 1986, Prasad and Rao, 1988).

1-2- Application of forging in industry and the temperature needed to perform forging for steel and aluminum

1-2-1- Steel forging

Steel forging is studied under lab operational conditions based on three different temperature patterns, high temperature (hot), mediocre temperature (warm) and low temperature (cool).

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1-1-2-1- Steel forging under high temperature (between 950 and 1250 °C)

1- Proper plasticity
2- Low formation forces
3- Constant tensile strength

1-2-1-2- Steel forging under mediocre temperature (between 750 and 950 °C)

1- Low getting layered on the work piece
2- Toleration of narrower tissue from hot forge
3- Limited plasticity and formation of higher forces than hot forging.
4- Formation of lower forces compared to cool formation

1-2-1-3- Steel forging under mediocre temperature (temperature of process depends on room temperature and for bending the temperature is increased by 150 °C)

1- The narrowest possible toleration
2- Without getting work piece layered
3- Increased strength and decreased plasticity due to high tolerance against strain
4- Low plasticity and high formation forces
5- In industrial processes, alloys of steel stand in the first level of hot forging. Brass, bronze, copper and valuable metals and their alloys are produced using cool forging processes, while each metal need its own temperature (Doege and Behrens, 2010).

1-2-2- Examination of forging in aluminum industry

To achieve modified performance in forging, aluminum forging is performed in temperatures between 350 and 550 °C. It should be taken into consideration that forging less than 350 °C can lead to increasing yield, decreasing plasticity and cracking aluminum rods (Doege and Behrens, 2010). Due to

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high conductivity, this metal is only usable in preparing windows. In the following sections, welding forging for fittings used in reinforcement is studied (Doege and Behrens, 2010).

2- Introducing different methods for connectivity of fittings

2-1- Connectivity of forgings

Welding forging was invented in 1953 and used in rail transportation industry, and then applied widely in construction sector (Fukushima and Hasui, 1973). As construction increases, the issues regarding reinforcement and strength of the concrete structures are attracted many attentions in terms of residents and properties safety (Seifert and Meiners, 1981).

Fig. 1. Connectivity of forging (Mohammad Nejad and Ahangar, 2014)

2-2- Mechanical connectivity

Mechanical connectivity is performed using a lined holder coupling two ends of fittings.

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Fig. 2. Mechanical connectivity by a coupler (Mohammad Nejad and Ahangar, 2014)

3-2- Overlap connectivity

Overlap connectivity is produced by coupling two fittings in parallel and fastening them using a wire.

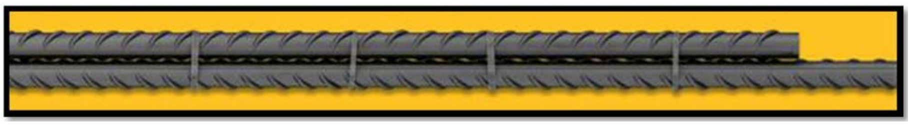

Fig. 3. Overlap connectivity (Mohammad Nejad and Ahangar, 2014)

3- Examination of mechanical tests for forging

The welded parameters in welding zone between fittings are studied here (Buts et al., 1979). Fig. 4 shows there is a proper resistance between two fittings applied in reinforcement structure. Different tests including bending test (Fig. 4) approve that there is no crack or damage to welding zone and this zone is as resistant as main body of the fitting and in some cases no damage can be detected in this zone, despite some damages detected in main body of the fitting (Shinozaki et al, 1999 and Kazakov, 1965).

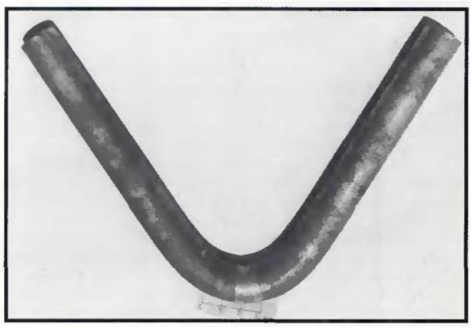

Fig. 4. Examination of welding resistance on the fitting using bending test (Rajamani et al. 1991)

Fig. 5 shows a sample underwent strength test. It can be seen that the welding zone stayed unchanged, whereas main body of the fitting was damaged (Shinozaki et al, 1999 and Kazakov, 1965).

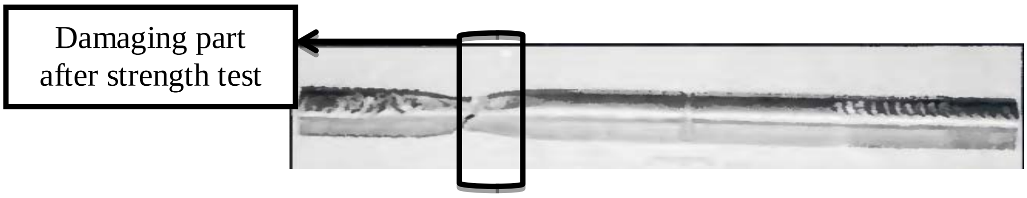

Fig. 5. Strength test on a fitting undergone welding forging (Rajamani et al. 1991)

In tensile test (Fig. 6), it is obvious that the main body of the fitting was completely split, however the welding zone stayed intact, proving the suitability of this welding in different phases, in particular in forging zone presented in Figures 3, 4, and 5 (Shinozaki et al, 1999 and Kazakov, 1965).

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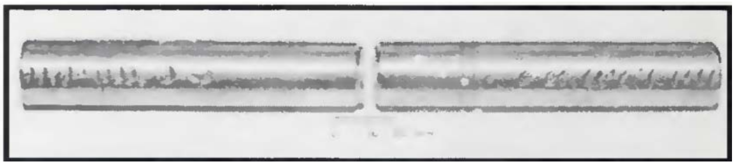

Fig. 6. Tensile test on a fitting undergone welding forging (Rajamani et al. 1991)

4- Conclusion

Using welding forging brings more advantages compared to other two methods. It is also able to minimize the waste side products. It is also worth pointing out that this method prevents excess load over both fabric of building structure and reinforcement.

References

Buts, B. D., Kvasha, A. N., and Kedrin, I. D. (1979). The effects of the deformation rate on the quality of friction welded joints. Automatic Welding. Vol. 32, No. 5, 18-20.

Doege, E. and Behrens, B. A. (2010). Handbuch Umformtechnik: Grundlagen, Technologien, Maschinen (in German), Springer Verlag, p. 7.

Doege, E. and Behrens, B. A. (2010). Handbuch Umformtechnik: Grundlagen, Technologien, Maschinen (in German), Springer Verlag, p. 67.

Dunkerton, S. B. (1986). Toughness properties of friction welds in steels. Welding Journal. Vol. 65, No. 8, 193-202.
Fukushima, S., and Hasui, A. (1973). Relation between rate of burnoff and welding conditions in continuous friction welding. Transactions of National Research Institute for Metals. Vol. 15, No. 5, 51-60.
Kazakov, N., F. (1985). Diffusion bonding of materials, Pergamon Press.
Mohammad Nejad, M. and Ahangar, M. (2014). AHP modeling for studying three type of fittings connectivity: overlap, coupling and forging, 6th national conference on concrete, Iran, Tehran
Prasad R. K. and Negeshwar R., P. (1988). Comparitive evaluation of T-1 (Type A) GMAW (C02) weld metals deposited using C-Mn and low-alloy filler wires. Proc. Int. Conf. on Weld. Tech. in Developing Countries, Univ. of Roorkee, India, 37-41.
Rajamani G. P., Shonmogam M. S and Rao K. P. (1991). Parameter Optimization and Properties of Friction Welded Quenched and Tempered Steel. WELDING RESEARCH SUPPLEMENT I, 229.
Shirazi, A. (2015). Diffusion Bonding, University of Cambridge. Revisited in 5th of February 2015.
Shinozaki, K., Kuroki, H., Lui, X., Ariyoshi, H., and Shirai, M. (1999). Welding Int. (UK), Vol. 13, No. 12, 945–951.
Seifert, D. A. and Meiners, R. (1981). Friction welding of maraging steel for small missile systems applications. ASM Engineering Bookshelf, source book on innovative welding processes, ASM, Ohio, 76-91.

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