© August 2020| IJIRT | Volume 7 Issue 3 | ISSN: 2349-6002

Effects of Tremix Concrete Flooring

Miss Neha Meshram [1], Prof. Dilip Budlani[2]
[1]*Research Scholar, Guru Nanak Institute of Technology, Nagpur*
[2]*Assistant Professor, Guru Nanak Institute of Technology, Nagpur*

***Abstract*—Flooring is used in the structure for easy utilization and trimix type of flooring is used in industrial purpose as the water content of this flooring is low but that type flooring is to be constructed on the slab of the structure. So basically, slab is the main component of the flooring. As the slab sustain the loading of flooring then that flooring is safe for to and for movement for human being and also for machineries. Design of slab for the multistory structure is evaluated in ETABS 2018 software. In this software, the various types of slab with their material properties is already added.**

It ought to be noticed that the plan of strengthened solid slab is an intricate subject and the structure codes spread numerous parts of this procedure. ETABS is a device to help the client in this procedure. Just the parts of configuration reported in this manual are computerized by ETABS structure abilities. The client must check the outcomes delivered and address different viewpoints not secured by ETABS.

***Index Terms*— ETABS, Spectral Acceleration, Spectral Displacement**

I.INTRODUCTION

A slab is bolstered on two backings or more. On the off chance that the heap is conveyed one way it is delegated a one-way piece and henceforth, just need fortification toward this path. On the off chance that the heap is conveyed in two ways it is delegated a two-way slab and will along these lines need support in two ways. The measure of fortification can contrast in the various headings of the slab bringing about an alternate solidness and bearing limit in these headings. A concrete slab is regular basic component of present-day structures. Flat slabs of steel fortified cement, regularly somewhere in the range of (100 and 500 millimeters) thick are frequently used to develop floors and roofs. On the specialized drawings, fortified solid slabs are regularly condensed to "R.C.C.slab" or essentially "R.C.". A fortified solid slab is abroad flat plate typically with almost equal top and base surfaces and may upheld by strengthened solid shafts or straightforwardly by slabs or stonework block divider or fortified solid dividers (Shear dividers).

Type of Slab Floor:

The decision of kind of piece for a specific floor relies upon numerous components. Economy of development is clearly a significant thought, yet this is a subjective contention until explicit cases are talked about and is a geological variable. The plan loads, required ranges, functionality prerequisites, and quality necessities are exceptionally significant. For beamless slabs, the decision between a flat piece and a flat plate is generally a matter of stacking and range. Flat plate quality is frequently administered by shear quality at the slabs, and for administration live loads more noteworthy than (4.8 kN/m2) and ranges more prominent than around (7 to 8 m) the flat piece is regularly the better decision. In the event that structural or different necessities preclude capitals or drop boards, the shear quality can be improved by utilizing metal shear heads or some other type of shear support, however the expenses might be high. Workableness prerequisites must be thought of, and diversions are now and then hard to control in fortified cement beamless slabs. Huge live loads and little cutoff points on passable diversions may drive the utilization of huge slab capitals. Negative-second breaking around segments is some of the time an issue with flat plates, and again a segment capital might be valuable in its control. Diversions and shear stresses may likewise be constrained by including pillars rather than segment capitals. On the off chance that extreme redirection limits are forced, the two-way slab will be generally appropriate, as the presentation of even decently solid shafts will lessen diversions more than the biggest sensible segment capital can. Bars are additionally effortlessly strengthened for shear powers. The decision between two-way and beamless slabs for increasingly typical circumstances is intricate. Regarding economy of material, particularly of steel, the two-way slab is frequently best on account of the enormous powerful profundities of the pillars. There is a characteristic human inclination to need to rehash what one has recently done effectively, and protection from change can influence costs. Be that as it may, old propensities ought not be permitted to rule sound building choices.

II. LITERATURE REVIEW

A few scientific strategies were directed to explore the conduct of pillar to-section joints exposed to cyclic stacking. These examinations used both bond-slip behaviors and joint shear behavior in ineffectively point by point RC outline joints, for example Filippou (1993); Elmorsi et al (2000); Calvi et al (2002); Fabbrocino et al (2004); Eligehausen et al (2006); and Favvata et al (2008). A large portion of these investigates inferred that the quality misfortune in joints can't be anticipated precisely by considering bond-slip reaction and utilizing a slip-based disappointment rule. Regardless of the broad logical and the shear limit of the joints. The mistakes were basically because of prolongation of plastic pivots not being caught precisely. In any case, in every one of these models' floor slab has been disregarded or just halfway thought of (Unal and Burak 2013) as a quality contributing element for seismic execution of the joints. Likewise, these models did not account together for the pillar extension and slab impacts at the associations. Fenwick and Davidson (1995) proposed a basic logical model for shaft extension without considering the section impact. A six story, three-narrows outline was dissected, with and without the shaft extension components. The more noteworthy bar extension happened with more prominent bar profundities and story float proportions; so, they have recommended that the pillar prolongation is corresponding to the shaft profundity hb and to the quantity of sounds nb. A pillar prolongation coefficient β is characterized by:

$$\beta = \Delta / [\, n_b h_b (\theta - \theta_o)] \qquad (1)$$

where Δ=beam stretching at a story; θ=storey float proportion; and θo edge float proportion, past which shaft extension happens (0.5%). The physical understanding of beta is that β increased by the shaft tallness is around double the separation between the impartial hub and the mid stature of the bar; along these lines, they propose an estimation of around 2/3 for this coefficient.

Kim et al (2004) built up a joint model to speak to the nonlinear conduct of shaft segment joint for strengthened solid edge. The joint itself was expected to carry on inflexibly and every inelastic activity were thought to be at shaft segment interface, the model was checked with exploratory consequences of Zerbe and Durrani (1989) and the model caught obviously the pillar prolongation impact. Five story, four-straight RC outline was examined with and without thinking about the bar lengthening. Critical changes in the appropriation of powers were watched considering the shaft stretching impact; notwithstanding this model didn't consider slab impact. Just a couple have considered hole opening (bar unwinding) impacts, which impact the edge/piece conduct, for example, Shahrooz et al (1992), the model was restricted to the solid stacking as it were. MacRae and Umarani (2006, 2007) have proposed an idea for considering slab impact on building seismic execution. They have created straightforward model for unequivocal assessment of the slab impact on second opposing auxiliary frameworks which considers the piece commitment to the pillar over quality. The model catches significant parts of the conduct of strengthened solid joint with a story slab well. Be that as it may, these examinations were restricted to single associations. Other exceptionally refined models considering the two impacts were created by Lau (2007); Peng (2009); Gardiner (2011). The models are complex, it requires huge computational exertion and time, precise lattice and adequate capacity for the outcomes. In regardless of the general multifaceted nature of the model, there were a few inconsistencies between the explanatory expectations and the exploratory outcomes.

The current paper at first examinations some test outcomes, pertinent to two subassemblies examples tried under cyclic burdens, to assess the impact of the slab and shaft prolongation. Progressively, numerical recreations dependent on Finite Elements Models (FEMs) created utilizing the RUAUMOKO-2D have been performed to apply a straightforward model for a pillar segment subassembly with a sensible alignment for both the bar prolongation/unwinding and the section impacts. The model created ought to be fit of reproducing squeezing impact and solidness corruption with expected hysteretic circle as in fortified solid structures; lastly, to look at the conduct of a five-story, four-cove fortified solid edge under powerful stacking conditions considering both piece impact and bar development.

III. METHODOLOGY

Method to evaluate Structure

Create a New Model

We will start a new model using the following steps:

1. Set the units to kN and meter, "kN-m", using the dropdown box in the lower right corner of the ETABS screen.
2. Select the File menu > New Model command.
3. Click the No button in the New Model Initialization form. This indicates that we do not wish to use a previous model as the starting point for this model.
4. This now opens the Building Plan Grid System and Story Data Definition form, where much of the definition of the structure takes place.
5. Following are the specification of building.

- Grade of concrete- M 20
- Zone factor (Z) -0.36
- Grade of steel -Fe 500
- Response reduction factor (R)- 5.0
- Floor to floor height -3 m
- Importance factor (I) -1.0
- Ground floor height -0.750 m
- Soil type Medium soil- II
- Dead load- 4.5 kN/m2
- ECC. ratio (e) -0.05
- Slab thickness -150 mm
- Slab Type: 1. Shell Thin 2. Shell Thick 3. Membrane
- Effective stiffness (Keff) -79148.6 kN/m
- Force at 0 displacement (F0)- 1000 kN/m
- Stiffness of rubber in LBR (Kr) -72932.28 kN/m
- Columns -450 × 450 mm
- Bearing horizontal stiffness (Kb) -13854.3 kN/m
- Beams -300 × 450 mm
- Total bearing vertical stiffness (kv) -25386991 kN/m
- Live load on all floors -3 kN/m2
- Damping ratio- 5%

3.2.1 Fractional Safety Factors

The plan quality for cement and fortification is acquired by partitioning the trademark quality of the material by an incomplete wellbeing factor, γm. The estimations of γm utilized in the program are as per the following:

Fractional security factor for support, γs = 1.15(IS 36.4.2.1)

Fractional security factor for concrete, γc = 1.5(IS 36.4.2.1)

These variables are as of now consolidated into the plan conditions and tables in the code. These qualities can be overwritten; in any case, alert is prompted.

3.2.2 Slab Design

ETABS slab plan system includes characterizing sets of strips in two commonly opposite bearings. The areas of the strips are typically represented by the areas of the section bolsters. The hub power, minutes and shears for a particular strip are recuperated from the investigation (based on the Wood Armer technique), and a flexural configuration is completed dependent on a definitive quality structure technique.

The section structure technique includes the accompanying advances:

- Structure flexural support
- Configuration shear support
- Punching check

3.2.3 Plan Flexural Reinforcement

For slabs, ETABS utilizes either configuration strips or the limited component-based plan to ascertain the piece flexural fortification as per the chose structure code. For effortlessness, just strip-by-strip configuration is archive in the procedure areas.

The plan of the piece fortification for a specific strip is done at explicit areas along the length of the strip. These areas compare to the component limits. Controlling support is processed on either side of those element limits. The piece flexural plan methodology for each heap blend includes the accompanying:

- Decide considered pivotal burdens and minutes for every slab strip.
- Plan flexural support for the strip.

These two stages, depicted in the content that follows, are rehashed for each heap blend. The greatest fortification determined for the top and base of the slab inside each plan strip, alongside the relating controlling burden blend, is gotten and announced.

3.2.3.1 Determine Factored Moments

In the plan of flexural fortification of solid section, the calculated minutes for each heap mix at a specific structure strip are acquired by figuring the comparing minutes for various burden cases, with the relating load factors.

The piece is then intended for the most extreme positive and greatest negative factored minutes acquired from the entirety of the heap blends. Count of base support depends on positive plan strip minutes. In such cases, the slab might be structured as a rectangular or flanged piece area. Figuring of top reinforcement depends on negative structure strip minutes. In such cases, the slab might be planned as a rectangular or rearranged flanged piece area.

3.2.3.2 Determine Required Flexural Reinforcement

In the flexural fortification structure process, the program computes both the pressure and pressure support. Pressure support is included when the applied structure second surpasses the most extreme second limit of a separately strengthened segment. The client has the alternative of maintaining a strategic distance from pressure support by expanding the viable profundity, the width, or the quality of the solid.

The plan method depends on the rearranged illustrative pressure square appeared in Figure 3.1 (IS 38.1). The territory of the pressure square, c, and the profundity of the focal point of the compressive power from the outrageous pressure fiber, an, are taken as

$c = \alpha$ fck xu (IS 38.1)

$a = \beta$ xu (IS 38.1)

where xu is the profundity of the unbiased pivot, and α and β are taken as:

$\alpha = 0.36$ (IS 38.1)

$\beta = 0.42$ (IS 38.1)

where α is the decrease factor to represent supported pressure and the fractional wellbeing factor for concrete and is commonly taken to be 0.36 for the accepted explanatory pressure square (IS 38.1). The β factor thinks about the profundity to the focal point of the compressive power.

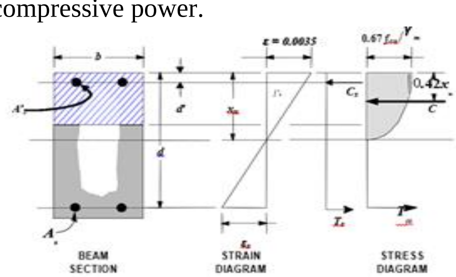


Figure 3.1 Uniform Thickness Slab Design

In this project we are follow the following steps: -

1. Set out the grid line with the 3 x 3 bays.
2. Draw base plan of building in the Etabs 2018 and multiply of the story upto 8th story. Each story height is defined as 3m and the height from base to plinth level is 750mm.

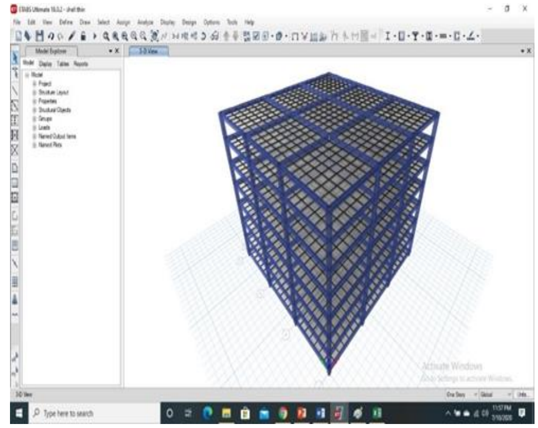


Figure 3.2 3-D model of multistory building

3. Specify the material properties like M20 for slab, column, and beam and HYSD 500 bar for reinforcement.

Table No. 1 Specification of Material Properties

Name	Type	E MPa	ν	Unit Weight kN/m³	Design Strengths
HYSD500	Rebar	200000	0	76.9729	Fy=500 MPa, Fu=545 MPa
M20	Concrete	22360.68	0.2	24.9926	Fc=20 MPa

4. Specify the width and depth for column and beam for the building. As we were take 450mm x 450 mm size of column and 300mm x 450mm depth for beam. We apply the material properties for the column and beam and apply to the building.
5. We take torsional constant as 0.7 for column and 0.35 for the beam as we take always 50% by the column. And the moment of inertia for beam and column is 0.01 kN/m2 about 2-2 and 3-3 axis respectively.

IV. RESULT AND DISCUSSION

Story Displacement

Story migration can be described as "It is the removing of a story with respect to the base of a structure". These the two terms are used in shudder or seismic structure plan. In this video one model has been taken to show the particular complexity between these two terms.

Table 3 Story displacements, response spectrum analysis, x and y -direction (mm)

	Shell Thick		Shell Thin		Membrane	
Story	X-Dir	Y-Dir	X-Dir	Y-Dir	X-Dir	Y-Dir
	mm	mm	mm	mm	mm	mm
Story 8	0.017	0.024	0.008	0.028	0.007	0.03
Story 7	0.016	0.022	0.008	0.027	0.006	0.028
Story 6	0.015	0.02	0.007	0.025	0.006	0.025
Story 5	0.013	0.017	0.006	0.021	0.005	0.021
Story 4	0.01	0.014	0.005	0.017	0.004	0.016
Story 3	0.007	0.009	0.003	0.012	0.002	0.01
Story 2	0.003	0.005	0.002	0.006	0.001	0.004
Story 1	1.27 E-04	1.75 E-04	7.16 E-05	2.48 E-04	5.22 E-05	2.34 E-04
Base	0	0	0	0	0	0

In the above table all the three type of slab displacement in x direction and y direction are shown.

Table 4 Story displacements in x -direction (mm)

Story	Shell Thick	Shell Thin	Membrane
Story8	0.017	0.008	0.007
Story7	0.016	0.008	0.006
Story6	0.015	0.007	0.006
Story5	0.013	0.006	0.005
Story4	0.01	0.005	0.004
Story3	0.007	0.003	0.002
Story2	0.003	0.002	0.001
Story1	1.27E-04	7.16E-05	5.22E-05
Base	0	0	0

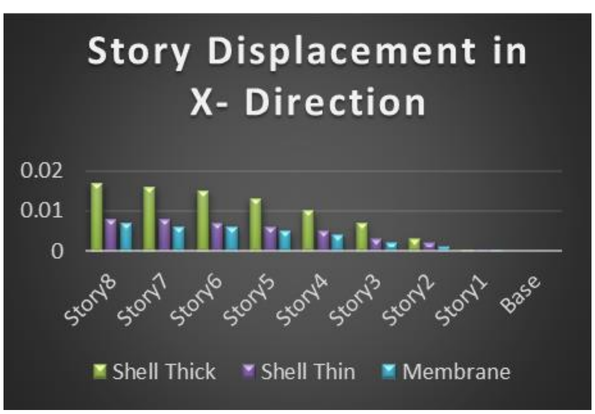


Figure 4.1 comparisons of story displacement in x direction

In the above graph the story displacement of membrane slab of the top story is too much less i.e. 0.007mm which is negligible as compared to other type of slab. The displacement in x direction is occur due to the wind load or seismic load in x direction which is input in the structure with the IS code 1893:2016. This IS code is latest version to be taken in the software program.

Table 5 Story displacements in y -direction (mm)

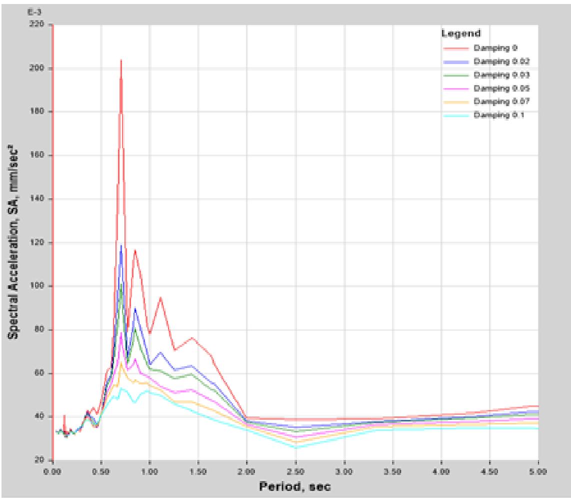
Story	Shell Thick	Shell Thin	Membrane
Story8	0.024	0.028	0.03
Story7	0.022	0.027	0.028
Story6	0.02	0.025	0.025
Story5	0.017	0.021	0.021
Story4	0.014	0.017	0.016
Story3	0.009	0.012	0.01
Story2	0.005	0.006	0.004
Story1	1.75E-04	2.48E-04	2.34E-04
Base	0	0	0

Figure 4.2 comparisons of story displacement in y direction

Story displacement of shell thick slab is less i.e. 0.024mm in y direction as compared to the other type of slabs. The y direction displacement is done due to the seismic waves which has high altitude in y direction.

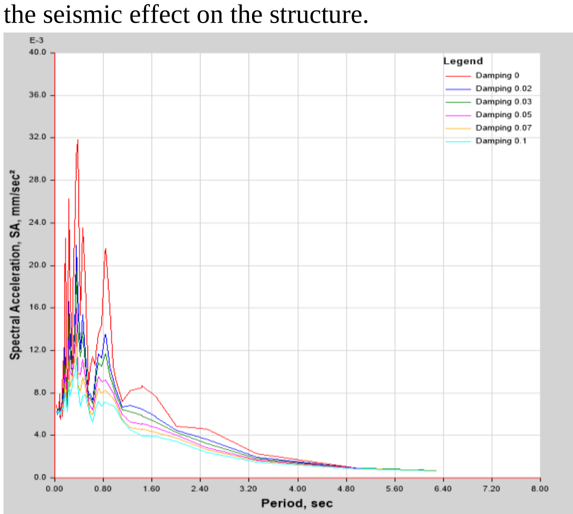
Spectral acceleration

SA (spectral acceleration) is approximately what is experienced by a building, as modeled by a particle on a massless vertical rod having the same natural period of vibration as the building. The plan reaction range gives a general system to gauge the normal powerful burden on a structure which is communicated as a component of characteristic period. Along these lines knowing the time of the structure, plan burden could be determined. It notable that the deterministic (DSHA) and probabilistic (PSHA) seismic hazard maps give forecast of pinnacle ground speeding up and ground movements for a particular site. According to NEHRP rules, structure reaction range is created from the PSHA system.

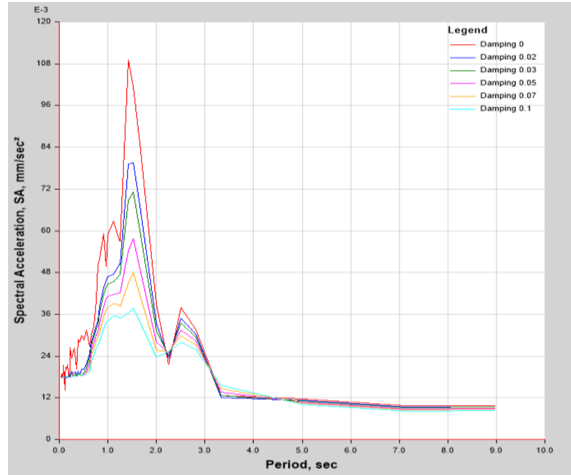


Spectral acceleration of shell thick slab

Spectral acceleration of shell thick slab for 0 damping ratio has a maximum value of 200 mm/sec2. It is seen that less damping ratio has a maximum spectral acceleration and for higher damping ratio has less spectral acceleration of the structure. Spectral acceleration is the movement of the structure due to the seismic effect on the structure.



Spectral acceleration of shell thin slab



spectral acceleration of membrane slab

As above graph shows that within 1 sec to 2 sec. the spectral acceleration is more i.e. up to 108mm/sec2 which is higher than that of shell thin slab. It means that the movement of the structure due to seismic loading is more in membrane slab. This spectral acceleration is differ by the type of slab viz. shell thin, shell thick and membrane slab. From this it is clear that shell thin slab has a less spectral acceleration with the various damping ratios.

Spectral acceleration graph is formed due to the response spectrum analysis of the structure. The EL centro 1940 data to be imposed in the structure and analyzed them. From this above result were getting.

IV. CONCLUSION

1. Basically story displacement is the main result of the structure and in this case the membrane slab has a less displacement rather than that of shell thick slab and shell thin slab but in practical manner it is very less for all type of slab.
2. Story drift ratio has to be calculated by using story height and the story drift in x direction and as per IS code criteria it is not greater than 0.025mm but in case of all slab type it is less than 0.025mm when it is evaluated so all design slab type has passed out story drift condition.
3. Spectral displacement is basically response spectrum term which were getting after the application of seismic load and response spectrum criteria. In that shell thick slab has a spectral displacement is less as compare to that of other type of slab.

4. Spectral acceleration is occur due to the seismic load and it is in x and y direction. The spectral acceleration take less time period in shell thick slab as compare to other type of slab.
5. Slab design parameter i.e. punching shear, top rebar intensity and cracking width has been passed by shell thick slab.

Future Scope

1. Layered type slab has to be design for the comparisons with the other type of slab.
2. Pushover analysis of the structure will doing for all type of slab.
3. Taken of various multistory building for the design with the comparison of slab will also be analyzed.

REFERENCE

[1] P. Hoogenboom, "Lectures on CIE4143 Shell Analysis, Theory and Application."

[2] J. Blaauwendraad and J. H. Hoefakker, Structural Shell Analysis, vol. 200 of Solid Me-chanics and Its Applications. Dordrecht: Springer Netherlands, 2014.

[3] E. Ramm and G. Mehlhorn, "On shape finding methods and ultimate load analyses of reinforced concrete shells," Engineering Structures, vol. 13, no. 2, pp. 178–198, 1991.

[4] E. Ramm, Ultimate Load and Stability Analy sis of Reinforced Concrete Shells.

[5] V. Weingarten, E. Morgan, and P. Seide, "Elastic stability of thin-walled cylindrical and conical shells under combined internal pressure and axial compression," 1965.

[6] L. Samuelson and S. Eggwertz, Shell Stability Handbook. 1992.

[7] R. Motro and B. Maurin, "Bernard Laffaille, Nicolas Esquillan, Two French Pioneers," 1968.

[8] L. Huxtable, Pier Luigi Nervi. G. Braziller, 1960.

[9] N. Walliman and B. Baiche, Ernst and Peter Neufert Architects' Data. Blackwell Science.

[10] R. N. Maten, "Ultra High-Performance Concrete in Large Span Shell Structures," tech. rep., 2011.

[11] T. Diana, Diana 9.5 User's Manual, 2014.

[12] Peerdeman, "Analysis of thin concrete shells revisited," tech. rep., TU Delft, 2008.

[13] E. Chao, "Pier Luigi Nervi 1891-1979," pp. 32–38, 2005.

[14] J. F. Abel and J. C. Chilton, "Heinz Isler - 50 years of "new shapes for shells"," Journal of the International Association for Shell and Spatial Structures, vol. 52, no. 169, pp. 131– 134, 2011.

[15] M. Millais, Building Structures: From Concepts to Design. Taylor and Francis, 2005.

[16] T. Iori and S. Poretti, "Pier Luigi NerviâĂŹs Works for the 1960 Rome Olympics," Small, pp. 27–29, 2005.

[17] Amway Center, "Production Guide Version 2,"