

Section 3 Commentaries

The commentaries in the following subsections were provided by committee members with expertise in particular technical disciplines. The titles and authors of each subsection are as follows:

- 3.1 **Geotechnical and Seismological Aspects** by Klaus Jacob
- 3.2 **Loads and Load Procedures** by Joseph Kelly
- 3.3 **Seismic Design of Nonstructural Components, Elements of Structures and Non-Building Structures** by Leo E. Argiris
- 3.4 **Application to Building Additions and Alterations** by Ramon Gilsanz
- 3.5 **Economic Impact Study** by Irwin Cantor

3.4 Application to Building Additions and Alterations

The Technical Policy and Procedure Notice (PPN) #4/96 shown in Figure 3-1 and the flow chart in Figure 3-2 address how enlargements and additions to buildings are affected by the local law 17/95.

Local law 17/95 applies to alterations that:

Enlarge the building area and require new or reinforced foundations.

Enlarge the building area and cost more than 60% of the value of the building. For this specific case, the applicant may solicit a waiver from the commissioner.

Local law 17/95 does not apply to alterations that:

Do not increase the building area regardless of: cost, change of use, and foundation work.

Enlarge the building area, but do not require new or reinforced foundations, and the cost of the alteration is less than 60% of the building value.

The enlargement and the existing structure can be connected or seismically isolated. If they are isolated, only the new construction has to comply with the local law 17/95. If they are connected and the enlargement is small compared to the existing structure, only the new construction has to comply with the new law. If they are connected and the enlargement is big compared to the existing structure, both have to comply with the new code.

To define what is a big or small enlargement, the seismic shear force and the seismic overturning moment for the enlarged building are compared to the seismic forces of the existing building. If the difference between the forces is less than 20% the enlargement is considered small and only the new construction has to comply with the law. If the increase in forces exceeds 20% the enlargement is considered big and the existing structure and the enlargement have to comply with the law. The code recognizes the hardship of upgrading an existing building and limits the amount of upgrade that has to be done by reducing the seismic forces. Hence, the enlarged building has to be designed for the lesser of:

- 1 Two thirds of the force generated by the enlarged building but not less than the seismic force of the enlargement alone.
2. Twice the force of the enlargement alone.

The following rules should be used to select the R_w for computing the seismic forces. When the existing structure has an undefined or code disallowed lateral load resisting system, use an $R_w=1$ that represents the elastic forces generated by the seismic event. When the lateral load resisting system is unreinforced masonry, use $R_w=1$. When the enlargement and the existing structure have a different lateral load resisting system, use the lowest R_w of the two systems to determine the seismic forces of the enlarged building.

The following examples clarify the intent of the law and are done without calculations and assumed results for brevity and conciseness. Note that there is a strong correlation between building area, weight of the building and seismic forces.

Case 1 controls when the enlargement is much bigger than the existing building. Example: Adding 30,000 square feet to a 10,000 square foot building. The combined 40,000 foot structure has seismic forces (shear or overturning moment) that are more than 20% higher than the forces in the original building. In this case, the resulting building is designed for two thirds the force required for the 40,000 square foot building but not less than the forces required for the 30,000 square foot extension. Case (2) does not control as it requires the enlarged building to be designed for twice the force of the 30,000 square foot extension.

Case 2 controls when the enlargement is smaller than the existing building. Example: Adding an exterior stair tower of 7,000 square feet to 30,000 square foot building. The combined 37,000 square feet have seismic forces (shear or overturning moment) 20% greater than the original structure. In this case, the resulting building is designed for twice the forces from the 7,000 square foot addition. Case (1) does not control as it requires a force that corresponds to two thirds of the 37,000 square foot building that is not less than the force generated by the 7,000 square foot new extension.

In some cases, the new addition is placed on top of an existing building and it may result in a new construction designed seismically on top of an existing building that has no seismic capacity. Example: three stories with a small footprint and framed in steel are added to a ten story unreinforced masonry building with a large footprint. It is assumed that some foundation reinforcing is required. When the seismic moment and shear for the thirteen-story building based on $R_w=1$ is computed and compared to the ten-story unreinforced masonry building with $R_w=1$, a force increase smaller than 20% occurs. The addition is seismically designed as a three-story building sitting on top of an existing building with a fixed top. In accordance with the local law, the ten-story masonry building is not upgraded and reinforced, but other sections of the code require that the thirteen-story building must withstand the present day code wind loads.

Note that if, in the above example, the three-story addition is supported on new or reinforced columns that go through the existing building to the foundation, then these columns should be laterally braced and must be designed according to code for a thirteen-story tower.

Technical Policy and Procedure Notice #4/96

Date Issued: March 29, 1996

Subject: Earthquake Code - Local Law #17/95 - Enlargements

Purpose: To provide guidelines to Professional Engineers (P.E.) and Registered Architects (R.A.) in the interpretation and application of Reference Standard RS 9-6, §2312(a)(1) enacted with Local Law #17/95, the Earthquake Code.

Effective: Immediately

Specifics: The Earthquake Code, Local Law #17/95, was promulgated for new construction; it does not affect an alteration where there is no enlargement of the existing structure. When proposed work includes an enlargement of the existing structure, compliance with Local Law #17/95 is required when new foundations are constructed or when existing foundations are reinforced to carry the enlarged portion of the building. In addition, the Commissioner will require that any enlargement in and of itself comply with Reference Standard RS 9-6 when the cost of the enlargement exceeds 60% of the value of the building, pursuant to §27-119 of the Code, within any twelve-month period, unless a waiver is granted by the Commissioner.

When compliance with RS 9-6 is required, consideration must be given to the interface between the existing and enlarged portion of the building. If a seismic joint (separation) is utilized, then only the new construction must comply with RS 9-6.

When no seismic joint is provided, the computed seismic forces of the entire proposed structure, (existing building plus the proposed enlargement), must be compared to the computed forces for the existing portion alone. The forces referred to herein are either base shear or overturning moment. If the increase in any seismic force resulting from the enlargement is less than 20%, compliance with RS 9-6 is required only for the new construction. If either of the seismic forces attributable to the enlargement increase by more than 20%, then the design force shall be the lesser of the following:

1. Two-thirds (2/3) of the combined force resulting from the combination of the new and existing construction but not less than the seismic force resulting from consideration of only the new construction;
2. Twice the seismic force resulting from consideration of only the new construction.

This design force shall be resisted by either the enlargement alone or a combination of the existing building and the enlargement depending on the design professional's choice of load resisting system and force distribution.

Figure 3-1 Technical Policy and Procedure Notice (PPN) #4/96

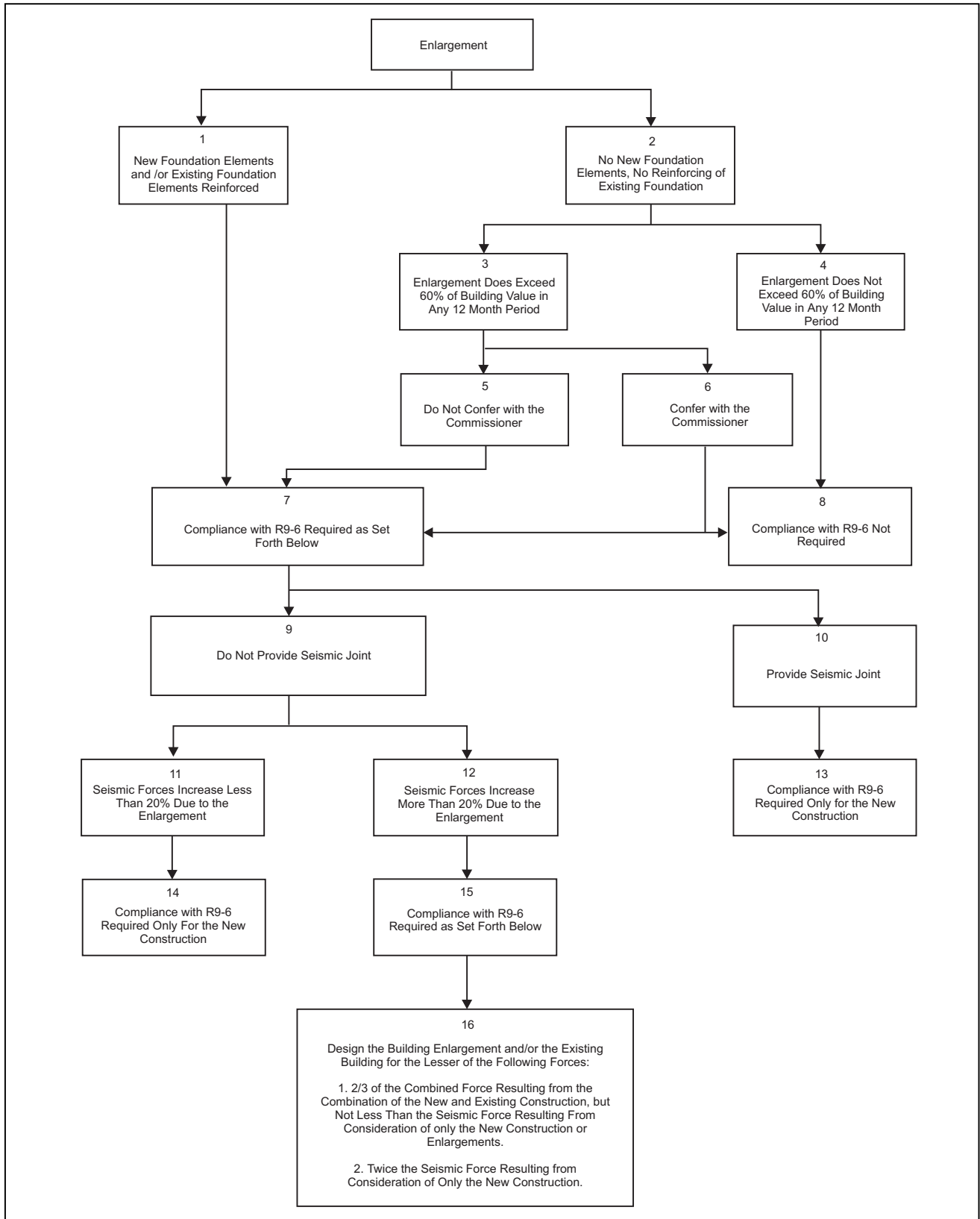


Figure 3-2 Proposed Seismic Regulations for Enlargements