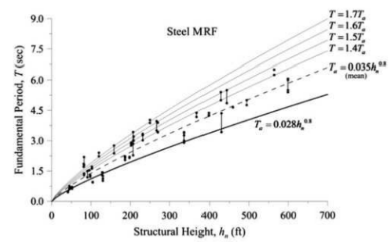
DOI	https://doi.org/10.1061/(ASCE)0733-9445(1997)123:11(1454)
Title	Period Formulas for Moment-Resisting Frame Buildings
Background	
Why this paper? How'd you find it?	It is one of a pair of articles cited by the building code for estimating building periods based on their heights. I wanted to see what methods were used to "measure" periods based on data. Found by mention of Prof. Mosalam.
Study Objective	Improve the period formulas used in the building code.
Intended gaps to fill	Lack of empirical data for "measured" periods from earthquake shaking.
Authors	Rakesh K. Goel and Anil K. Chopra
Affiliations	Syracuse University, Cal Poly SLO, UC Berkeley
Funding Source	NSF Grant CMS-9416265
Journal / Field	ASCE Journal of Structural Engineering
Date	11/01/1997
Historical Context	See ASCE-7 Section 12.8.2, part of the ELF (equivalent lateral force) procedure for estimating a building's shear demand during design. **12.8.2.1 Approximate Fundamental Period.** The approximate fundamental period (T_a), in seconds, shall be determined from the following equation: $$T_a = C_t h_n^x \quad (12.8\text{-}7)$$ where h_n is the structural height as defined in Section 11.2 and the coefficients C_t and x are determined from Table 12.8-2. Previous code formula $T = C_t H^{3/4}$ was derived with Rayleigh's method by Ch[illegible]95 for ATC3-06, with assumption of linearly distributed static lateral forces, seismic base shear proportional to T^(-2/3), and deflections controlled by drift limitations. Ct = 0.030 for RC and 0.035 for steel were derived from "measured" periods of buildings during 1971 Fernando earthquake. **C12.8.2.1 Approximate Fundamental Period.** Eq. (12.8-7) is an empirical relationship determined through statistical analysis of the measured response of building structures in small- to moderate-sized earthquakes, including response to wind effects (Goel and Chopra 1997, 1998). Fig. C12.8-2 illustrates such data 
Relationship to SEMM	CE 225, CE 227
Methods	
Given:	Recorded vibrations during earthquakes
Find:	An empirical formula for computing moment frame building fundamental periods based on height
Experimental Design	1. 90 vibrations recorded from instrumented moment frame buildings during the 1994 Northridge and 1971 San Fernando earthquakes. 2. System identification (see appx B) using (a) transfer function, (b) modal minimization method, and (c) autoregressive modeling to get "measured periods". 3. Regression analysis to get an equation of the form $T = \alpha H^{\beta}$ relating height to building period.
Test Subjects	27 reinforced concrete and 42 steel moment frame buildings
Results	
Baseline for comparison	Previous code formula $T = C_t H^{3/4}$
Metric for comparison	Visual comparison of period and resulting seismic coefficient vs height
Difference from baseline	"Measured" periods are longer than the code computed periods, especially for tall buildings, and the resulting seismic coefficient is generally smaller.
Conclusions	
Authors'	$T_L = 0.028H^{0.80}$ for steel frames $T_L = 0.016H^{0.90}$ for RC frames Regression analysis should be repeated periodically for larger datasets.
Yours	I wonder about doing some more statisical analysis on spread at each height rather than doing regression curve minus 1stdev. I also would like to compare with modern system identification methods to "measure" periods. I'd like to explore larger, more up-to-date datasets, like they suggest.
Applications	Design