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Construction Revolution – How Environmental Regulations and Technology Will Drive Major Changes in the Building Industry

I. Environmental Regulations and the Effect On the Building Industry

A. Historical Overview of Environmental Review

California experienced tremendous population growth beginning in the 1930's. According to U.S. Census data, California's population in 1930 was 5,677,251. By 1950 it had almost doubled to 10,586,223. By 1970 it reached 19,953,134, almost double that from 1950. By 1990 it was 29,760,021. As of 2015, it was 38,700,000.

A substantial majority of the population growth in the postwar era occurred in the suburbs. The proportion of the U.S. population living in suburbs grew slowly in the period between the two World Wars, from 17 percent to 20 percent. However, by 1970 more than one-third of all Americans lived in the suburbs, and the nation's approximately 75 million suburbanites for the first time exceeded the number of Americans living in cities. The United States had become a suburban nation.

The population growth was supported by large gains in home construction. Vast areas of land were subdivided into tracts to build new communities. Home sales were fueled by government policies that were enacted as a result of the Great Depression. The government created the Federal Housing Administration, Fannie Mae, and enacted the G.I. Bill after WW II. All of these efforts were designed to increase homeownership. Millions of homes were built to keep up with the demand.

But by the 1960's, the environmental movement was taking hold in the United States, and California enacted the California Environmental Quality Act (CEQA) in 1970. CEQA's basic goal was to inform governmental decision makers and the public about the potential significant environmental effects of projects and how to mitigate them.

CEQA was a game changer for the building industry and it has stopped or delayed innumerable projects. The costs of building projects that were approved increased significantly. Over the years, the number of CEQA challenges continued to grow in frequency and complexity. CEQA challenges started out as pretty basic and looked at a project's impact on traffic, air quality, noise, protected species, and public services such as fire, police, and schools. But as California adopted new environmental laws and

regulations, builders found themselves analyzing new impacts not previously considered, such as greenhouse gases under the California Global Warming Solutions Act of 2006 (aka "AB 32").

The purpose of AB 32 is to reduce green house gas emissions to 1990 levels by 2020 - a reduction of approximately 30 percent, and then an 80 percent reduction below 1990 levels by 2050.

B. Center for Biological Diversity v. CA Dept. of Fish and Wildlife - Newhall Land

1. Background on the Newhall Land decision

In a 5-1-1 ruling on November 30, 2015, the California Supreme Court rejected the approval of an environmental impact report (EIR) for the Newhall Ranch project because the EIR did not adequately address the cumulative impact of the project's greenhouse gas emissions under AB 32.

The Newhall Ranch project has been on the drawing board for two decades. The planned community is in the foothills north of Los Angeles and would house 58,000 people and offer stores, golf courses, schools and recreational centers on 12,000 acres. Los Angeles approved the project 14 years ago.

An EIR thousands of pages long was approved in 2010 but was successfully challenged in the Los Angeles Superior Court on a number of points, including that the EIR did not correctly evaluate the project's greenhouse gas emissions, thereby violating AB 32. The Court of Appeal reversed, rejecting all of the plaintiff's CEQA claims, and the Supreme Court granted the petition to review.

In writing for the majority, Justice Werdegar framed the question as follows: "The challenge for CEQA purposes is to determine whether the impact of the project's emissions of greenhouse gases is cumulatively considerable, in the sense that 'the incremental effects of [the] individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.' [Citation omitted.]"

The Newhall Ranch EIR's analysis of greenhouse gases centered around a plan prepared by the Air Resources Board (commonly referred to as the Scoping Plan). The Scoping Plan concluded that to hit the goals of AB 32, it meant cutting approximately 30 percent from "business-as-usual" (*i.e.,* doing nothing further to address climate change) emission levels projected for 2020.

The Newhall Ranch EIR attempted to quantify the emissions generated on the project site in its existing uses and the emissions that would be generated by full development of the Newhall Ranch community. Annual emissions from the existing uses (primarily oil wells and agriculture) were estimated at 10,272 metric tons of CO2, which the EIR treated as zero for purposes of the impact analysis. The annual greenhouse gas emissions from Newhall Ranch at full build-out were projected to be 269,053 metric tons of CO2 equivalent (MTCO2E).

The EIR asserted that while this annual emissions increase of 269,053 MTCO2E is "an obvious change to existing, on-site conditions," the global nature of climate change and the "absence of scientific and factual information" on the significance of particular amounts of greenhouse gas emissions make the change "[in]sufficient to support a significance determination." The EIR went on to consider "whether

the proposed Project's emissions . . . would impede the State of California's compliance with the statutory emissions reduction mandate established by AB 32."

The EIR's method for determining whether the project would impede achievement of AB 32's goals was to estimate the projects emissions under "business as usual" - 390,046 MTCO2E - compared to what it intended to build – 269,053 MTCO2E. Because "the estimate of actual annual project emissions (269,053 MTCO2E) is 31 percent below its business-as-usual estimate (390,046 MTCO2E), exceeding the Air Board's determination of a 29 percent reduction from business as usual needed statewide, the EIR concluded the project's likely greenhouse gas emissions will not impede achievement of A.B. 32's goals and are therefore less than significant for CEQA purposes."

The Supreme Court found there was "no substantial evidence" to support the EIR conclusion that the completed project's green house gas emissions posed no significant impacts and would be consistent with California A.B. 32's statewide goal of a 29 percent reduction in such emissions. The Supreme Court went on to say: "Given the reality of growth, some greenhouse gas emissions from new housing and commercial developments are inevitable. The critical CEQA question is the cumulative significance of a project's greenhouse gas emissions, and from a climate change point of view it does not matter where in the state those emissions are produced. Under these circumstances, evaluating the significance of a residential or mixed use project's greenhouse gas emissions by their effect on the state's efforts to meet its longterm goals makes at least as much sense as measuring them against an absolute numerical threshold." [Emphasis added.]

The majority appears to have adopted a theory advanced by the Plaintiffs that a greater degree of reduction may be needed from new land use projects than from the economy as a whole because designing new projects for maximum energy efficiency and renewable energy is more likely to occur than achieving the same savings by retrofitting of older structures and systems…"Indeed, it seems that new development must be more [greenhouse gas]-efficient than this average, given that past and current sources of emissions, which are substantially less efficient than this average, will continue to exist and emit." [Emphasis added.]

For these reasons, the majority concluded the EIR did not adequate address the cumulative impacts of greenhouse gases from the project and sent the matter back to the trial court for further proceedings.

Justice Corrigan wrote a dissenting opinion on the greenhouse gas issue in which she hit on many of the difficulties that builders would encounter in trying to comply with the Court's reasoning. She wrote:

> …the majority's analysis implicitly assumes project-level reductions in greenhouse gas emissions must be greater than the reductions California is seeking to achieve statewide. It reasons that, because new developments can incorporate the most advanced technology, they may presumably achieve greater efficiency than is possible through retrofitting existing buildings. Thus, considering all greenhouse gas sources across the state, regulators may expect greater emissions reductions from new developments. …This argument may be reasonable in the abstract, but in my view it is too amorphous a ground for invalidating a carefully prepared and thorough EIR. Although lead agencies must consider whether a project's impacts are "cumulatively

> considerable" in light of existing and future projects…no CEQA provision places the responsibility on developers to mitigate environmental impacts caused entirely by other projects. Moreover, the majority does not identify just how much better than the statewide goal new projects must be. The "Scoping Plan" for Assembly Bill 32 did not suggest, let alone mandate, specific efficiency levels for new development projects. Nor does the majority opinion indicate what specific level of reduction would be sufficient for Newhall Ranch to demonstrate consistency with Assembly Bill 32. It is not clear why a 31 percent reduction, to be achieved by the one of the largest development projects in the state's history, is necessarily inadequate.

Justice Corrigan went on to criticize the majority's conclusion that the EIR failed to demonstrate a quantitative equivalence by stating: "we have no assurance it is even possible to calculate how a statewide goal corresponds to specific, quantitative efficiency measures for individual projects."

Justice Chin wrote a strong dissent observing that many different agencies had scrutinized this project and despite their efforts there was no scientific consensus as to how large a reduction at the project level was needed to establish consistency with Assembly Bill 32's statewide goal. More importantly, Justice Chin wrote:

> We have 'caution[ed] that rules regulating the protection of the environment must not be subverted into an instrument for the oppression and delay of social, economic, or recreational development and advancement.' Today's opinion threatens this very subversion.
>
> The Newhall Ranch project has been very long in planning, approval, and litigation. The current EIR was finalized some five years ago. The two flaws the majority has found in the EIR can easily be fixed…
>
> The harm is in delay. This litigation has already delayed implementing the EIR some five years or so. Now this court is sending the case back to the Court of Appeal. Among other things, it is permitting the project opponents to relitigate some already decided issues even though the Court of Appeal fully rejected the arguments the first time. It also leaves it to the Court of Appeal, or perhaps to the superior court on a further remand, to decide the exact parameters of the writ of mandate to be issued… At some point, this appeal will end, and the writ will issue. At some point after that, the EIR will have to be revised, with the necessary period of public comment, etc. (although presumably limited to the two flaws the majority has found). Then it is predictable that yet more litigation will follow the finalization of the new EIR. Given the glacial pace of litigation, this will easily take years."

2. Discussion concerning why the Newland Land decision is important

According to the Environmental Protection Agency, human activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years. The primary sources of greenhouse gas emissions in the United States are:

- Electricity production (30% of 2014 greenhouse gas emissions) - Electricity production generates the largest share of greenhouse gas emissions. Approximately 67% of our electricity comes from burning fossil fuels, mostly coal and natural gas.
- Transportation (26% of 2014 greenhouse gas emissions) - Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 90% of the fuel used for transportation is petroleum based, which includes gasoline and diesel.

Newhall Land is of major significance to Builders because projects necessarily require activities that will lead to greenhouse gases but people who will live in the project are already producing greenhouse gases somewhere else. Thus, whatever greenhouse gases a project may cause should not be viewed as a "gain" in greenhouse gas emissions.

Despite a discussion of "potential options" and an acknowledgement that AB 32 does not provide a project-specific analytical framework, the Newhall decision gives builders little or no practical advice on how to comply with AB 32.

Exactly how a builder can adequately address the cumulative impacts of a project "when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects" is not only unknown and likely impossible. How many other projects must be analyzed? How must they be analyzed? How can a builder even find these projects and evaluate them?

These are major issues that could very well wind up stalling development of future projects.

3. Suggestions for Appropriate Use of the Business-as-usual (BAU) Methodology

The Court concluded its ruling with some suggestions for applying the BAU methodology. First, lead agencies can use the comparison to BAU methodology if they also determine what reduction a particular project must achieve in order to comply with statewide goals. Second, project design features that comply with regulations to reduce emissions may demonstrate that those components of emissions are less than significant (but the Court cautioned that energy-efficient buildings would not be a basis for finding that transportation emissions are less than significant). Lead agencies could also demonstrate compliance with locally adopted climate plans, or could apply specific numerical thresholds developed by some local agencies.

Using AB 32 compliance as a threshold of significance was upheld in *Newhall*, but the twist is that new development may have to do better than the statewide 29% below BAU because the court assumed that existing development would not change its GHG emissions profile so new development has to compensate for existing development and existing emissions. This is not a science-based assumption. The two main ingredients of GHG emissions for residential are (1) the car trips associated with the residence and (2) the source of gas/electric power to residence. Both of these emissions sources are subject to dramatic improvements regardless of whether a new or existing home. For example, if you buy a Tesla it doesn't matter whether you live in an existing or new home, your auto-related GHG emissions just went down the same amount. By the same token, if Edison purchases more "clean"

energy (wind, solar, etc.) that power is distributed to existing homes just like new homes. Moreover, the statewide cap and trade policy is designed to meet AB 32 and is ratcheting down emissions for fuel and energy sources.

Builders should explore whether there are additional programs that can be complied with to show a project will not obstruct *statewide* compliance with AB 32. For instance:

1. Local agencies are adopting Climate Action Plans (CAP) and they often include some localized calculation of what the area needs to achieve, so compliance with a local CAP can help bridge the analytical gap between AB 32 statewide and what needs to be done locally.

2. Similarly, BAAQMD and SCAQMD as examples, have numeric GHG-emissions thresholds to meet which they have calculated as achieving or beating AB 32 compliance, so they can be used as standards to bridge the analytical gap.

3. Augment compliance with CAP and regional plans by showing how specific project incorporates GHG-saving features that meet or exceed regulatory standards (energy efficiency, solar panels, electrical outlets for car charging, etc.)

4. There is some notion of considering that by building new energy efficient residences (or offices or retail, etc.) folks will be moving to it from less efficient structures so just bringing this new development on-line helps when compared to where the population was before (this is untested and of course subject to rebuttal because someone else is coming in to take the place of the old residents in the old space).

C. How Environmental Regulations Will Drive Changes in Construction Defect Litigation

Once a builder successfully manages the CEQA process, how will these homes be designed?

California has adopted "CalGreen" which is a more stringent building code that requires, at a minimum, that new buildings and renovations in California meet certain sustainability and ecological standards. It means every new building built after January 1, 2011 will need to meet a certain baseline of efficiency and sustainability standards, raising the bar for what is allowable. CalGreen applies to commercial and residential projects and is designed to reduce emissions to pre-1990 levels.

CalGreen has minimum baselines that must be met in order for a building to be approved. These range from water efficiency, indoor air quality, and sustainable building materials.

The building industry has responded by producing homes that are "zero net energy," that employ water saving technologies, and incorporate new building materials. The production of these homes will likely open the door to new areas of litigation. Take for example a home that is marketed as "zero net energy." A consumer may think that he/she may never receive an electricity bill again. That's not necessarily the case. Zero net energy requires the homeowner to follow certain practices to achieve the goal of zero net energy. Disputes about the marketing and efficiency of zero net energy homes will

likely happen. The same holds true for water conservation and homes that might not fulfill the consumer's expectations on these homes.

Finally, new building products that are designed to improve efficiency may themselves be defective. The materials might be defective because they do not work as intended, or because they fail, or they are harmful.

D. Insurance Coverage Implications for New Defect Issues

Homes have always been a product. Historically, when that product failed, a roof leaked, stucco cracked, or a water line burst. The homes of the future will be no different in these respects, but they will have a lot more opportunities to fail when compared to the homes built in the 1990's or the early 2000's. Modern homes will become "smart homes" by incorporating these new technologies and they will be connected to the internet and controlled from your phone anywhere where there is an internet connection. But will current insurance products cover a builder for a home that does not save enough energy or water? Will it cover a builder from claims that a home is not functioning as intended? Will new insurance products come to the market to cover risks presented by this technology?

II. How Technology Will Change Homebuilding and Construction Defect Litigation

A. Changes in How Homes Are Built

A labor shortage in the construction industry and technology are causing rapid advances in construction building technology. According to the National Association of Homebuilders:

"Recent survey data from NAHB show that shortages of labor and subcontractors have become substantially more widespread since 2013. The incidence of reported shortages is now surprisingly high relative to the current state of new home construction, which has only very partially recovered from its 2008 downturn. The shortages are also particularly acute for workers with basic skills like carpentry, who are needed in substantial numbers for the construction of any home."

According to an article from the Wall Street Journal:

" 'By 2030, 90% of jobs as we know them today will be replaced by smart machines,' three analysts from the research firm Gartner Inc. wrote in a 2013 report. They defined smart machines as ones doing things previously thought doable only by people, such as learning from experience. Machines, they said, 'are evolving from automating basic tasks to becoming advanced self-learning systems mimicking the human brain.'"

"By 2050, such machines are likely to 'do every job that we presently do,' says Vivek Wadhwa, a fellow at Stanford University and frequent writer on technological trends. 'The more I look forward, the more convinced I am that jobs won't be about sustenance any more. Since everything will be so cheap, our jobs will be about knowledge and the arts. This is what will keep us busy.'"

Fewer and fewer young workers are going into the building trades and one study has shown that 86 percent of builders in the United States reported last year having trouble filling those jobs. That's happening even though more than half are increasing their wages to recruit and retain the workers they need. What's more, the median age of construction workers is 42, and over the next decade, much of the present labor force will approach retirement.

The confluence of technology and the labor shortage will drive the industry to drones, robots and 3-D.

1. Drones: The expanding use of drones, officially referred to as "unmanned aerial systems," promises to revolutionize the construction industry. Drones have the potential to allow builders to efficiently and economically inspect project conditions, monitor work quality, identify safety hazards, and provide real time feedback to project managers, architects and owners. Although commercial use of drones is still prohibited without a special exemption, developments in 2015 evidenced that legalization of such use is within reach.

Overall, drone use is an exciting prospect for the construction industry, and could be as revolutionary as the cell phone or laptop. However, before jumping onto the drone bandwagon, builders planning to operate drones should understand the rules and regulations that the FAA has adopted and also have insurance policies that cover liability arising from drone use.

2. Robotics: Robots are already here and they are going to become more prevalent. Examples of this include a report from MIT Technology Review from September 2015 that documented a robot named SAM (Semi-Automated Mason) that could lay bricks three times as fast as a normal mason.

According to the designer, "SAM's purpose is to leverage human jobs, not entirely replace them—a human mason can lay about 300 to 500 bricks a day, while SAM can lay about 800 to 1,200 bricks a day. One human plus one SAM equals the productivity of having four or more masons on the job." According to the article, SAM is smart as it is productive: "The robot can correct for the differences between theoretical building specifications and what's actually on site" according to SAM's designer.

The applications for robots go well beyond brick laying. The technology will eventually be adopted that would allow robots to perform just about any construction activity from foundations to framing, installing windows, roofs, floor coverings, and just about anything else. When a robot is programmed to install 16d nails twelve inches on center, that's what it will do. It will not install 8d nails sixteen inches on center. When robots are programmed on the proper sequence to flash a building exterior, it will be done that way, with the proper materials. A significant amount of construction defects arise when the trades do not follow the schedule and do things out of order. Utilizing robots will put these sequencing issues to an end, will improve the quality of construction by eliminating mistakes, and will greatly enhance the quality of the finished product.

Robots will go beyond land-based units and into the sky with robotic drones. As reported in Building Design + Construction, the Swiss firm Gramazio & Kohler collaborated on project in France in which a team of as many as 50 flying robots built a structurally stable, twenty foot tower out of 1,500 Styrofoam

blocks. While the experiment was on a basic structure, the technological advances of drones will likely enable drone robots to do all sorts of work in the future, such as installing and welding steel on high-rise buildings and carrying and pouring concrete, among other many applications. There is another benefit to robots and that is the simple fact that labor costs are a significant factor in the cost of any structure. California's shortage of affordable housing has reached crisis levels and the use of robots could very well improve home affordability in a big way by reducing not only labor costs by the time it takes to build a home.

3. 3D Printing:

The uses of 3D printing seem to be growing every day. But what is 3D printing? "3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process, an object is created by laying down successive layers of material until the entire object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object." In the construction process, these printers can be very large and not something that you can put on your desk."

Companies such as Contour Crafting are now providing the technology to print entire structures. According to its website, "Contour Crafting (CC) is a layered fabrication technology…has great potential for automating the construction of whole structures as well as sub-components. Using this process, single or multiple homes may be automatically constructed in a single run, embedded in each house all the conduits for electrical, plumbing and air-conditioning.

A Dutch company is building a steel bridge in Amsterdam using 3-D printing. In a very notable story, a Chinese company built ten houses using 3-D technology, but some controversy exists on that project because of claims that the company might have infringed on Contour Crafting's patents. Recently, a team of UC Berkeley researches created a nine-foot high 3D cement-printed structure.

Thus, 3D is not just hyperbole; it is happening, and has wide-ranging positive and negative implications.

According to the website ForConstructionPros.com, some advantages include:

- Faster and accurate construction
- Reduced labor cost
- Reduced waste generation and increased use of recycled products
- Reduced health and safety risk

Some disadvantages include:

- Reduced employee numbers
- Multiple printers needed for multiple applications
- Transportation and storage of the printers
- Systemic problems if printer not properly designed or programmed

B. Will Technology Kill Construction Defect Litigation, or Just Create New Issues?

Construction defects can arise in a multitude of settings and can be caused by any number of factors. A worker who is not feeling well or who is preoccupied by his fantasy football team will lack focus and increase the chances of a mistake in the field. Machines will not have those problems, they will do as they are programmed. They will use the correct nails and nail them as specified. They will use the right mix for the stucco and install stucco with the proper thickness. Robots might break down but they will do as they are programmed. And that is where many future problems will arise.

If a robot is given incorrect instructions it will follow the instructions. Thus, programming error is a major risk in future projects. If the programming error is not discovered until dozens of houses are built, then all that work would potentially need to be redone. If the error is not discovered until after a construction defect suit, plaintiffs will not have to struggle with extrapolation evidence like they do today. The programming error will tell the story.

If a 3D printer is supplied the wrong additive material by a human, that could lead to major problems. Image if a 3D printer prints an entire subdivision's worth of concrete foundation slabs incorrectly. The losses would be enormous.

Technology will change the face of construction defect litigation. It will become highly technical and experts will needed to look at the source code of robots and 3D printers to determine whether they were programmed correctly.

Finally, there is always the possibility that the machine doing the work will itself be defective.

C. Insurance Underwriting Implications for New Defect Issues

Insurance underwriters will be at the forefront in addressing the risks presented by these new technologies. Underwriters will need a thorough understanding of a builder's construction processes and technology utilization before agreeing to insure a builder and/or project with such technology. Some questions involving robots and 3D printers will be:

- Where does this equipment come from and who makes it?
- What is the track record of this equipment?
- Who is responsible for programming the equipment to meet job specs?
- What safeguards in place to ensure the lay-outs, specs, and programming are accurate?
- What quality control measures are in place to ensure the equipment operates correctly?