

Construction Challenges Associated with the Sudden Population Growth in the Williston Basin Oil Boom

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During the oil boom in the Bakken Region of North Dakota commencing in 2009, the sudden population surge in the Williston Basin area caused a housing crisis for both the oilfield workers and the small rural communities. Numerous forms of housing solutions were utilized in an attempt to accommodate the rapid influx of workers servicing the oilfields and related industries, most commonly in the form of temporary “man camps.” This rapid population growth quickly strained local development processes, construction and engineering resources, and agencies tasked with regulating occupancy and housing standards. This paper identifies the sequential order of the various temporary housing options utilized. The initial response to the planning, construction, and development of temporary housing facilities in the Williston Basin was not optimal or effective. This paper also discusses both positive and negative lessons learned from the development, construction, and regulatory sectors regarding the sequence of housing options utilized. The paper provides a useful case study for avoiding or minimizing similar mistakes in future sudden population growth cycles.

Keywords: Temporary Housing, Man Camp, Williston Basin, Bakken Region

Introduction

The sudden relocation and mass movement of human populations can often be associated with a lack of immediate availability and options in housing. For instance, during the 19th century, the California gold rush brought large numbers of people to previously sparsely populated places. After gold was discovered at Sutter’s Mill in January 1848, within only six months there were already an estimated four to five thousand miners in the gold field. By December 1849 the number had swelled to 40,000, and then ultimately peaked around 100,000 miners in 1852 (Clay and Wright, 2005). Although gold was plentiful, housing was at a premium. In San Francisco poorly built small buildings rented for thousands of dollars per year, and practically every square inch of available space was rented for lodging. Many simply lived in tents (Peterson, 1849). Chaos seemed to be the leading result of the housing shortage.

In more recent times another population surge surrounded the construction of the Hoover Dam during the 1930’s, where over 1,500 buildings were constructed to house more than 5,000 dam workers. In this instance, the more formal solution of establishing Boulder City, and the associated infrastructure of water, sewer, electricity, and roadways, was built in direct response to the need of housing the dam construction workers. This much more organized approach to solving the housing crisis resulted in the first fully developed new town during the Community Planning Movement (Rogers, 2010).

Although the historical California gold rush and Hoover Dam construction examples contrast two very different approaches, a more recent example can be used to examine problems and solutions associated with a modern housing shortage. Beginning in 2009, a migration commenced once again in the United States, as thousands of people relocated northerly to areas surrounding the Bakken oil formation spread across portions of North Dakota,

Montana, and Canada (Dobb, 2013). This recent influx of people has resulted in a rolling housing crisis throughout the Bakken region. This paper investigates the dynamics of the response to the oil boom housing crisis, specifically examining the growth associated with the Williston Basin in North Dakota. Additionally, this paper outlines a series of lessons learned as the housing process has progressed. Although these findings are specific to the region surrounding the Bakken oil formation, the lessons learned are universal in nature.

Temporary Housing Dynamics

Oil extraction has been occurring in the Bakken region of North Dakota for decades. However, new technological advances regarding oil extraction methods caused a new population boom to begin in about 2009. (Bohnenkamp et al., 2011). The Williston Basin area experienced a significant influx of workers, with its population doubling from an estimated 12,500 in 2010 to roughly 25,000 in 2012. Projections indicate that the total population might reach 60,000 within an additional 3-5 years (Kemnick, 2012). These large numbers of workers arriving in the Williston Basin required housing in remote locations where sufficient housing options were lacking. As a result, a variety of housing solutions were utilized.

The sudden population growth occurring within the Williston Basin initially caused existing hotels and motels to quickly be booked to capacity (Wanjek, 2013). The limited apartment and rental houses available were also soon occupied. This in turn led to the arrival of numerous campers, trailers, and 5th wheels which inundated the existing RV parks (Herr, 2013). Once the existing housing resources were exhausted, other creative measures were taken as illegal RV parks sprung up along back roads, various forms of temporary housing such as FEMA trailers, modified shipping containers, new and used mobile homes, and make-shift shelters of all kinds also made their way to the area (Davies, 2012, Bevill, 2013). Housing costs in general began to swell, with hotel rooms reaching \$300 a night and small portable units renting for nearly \$3,000 per month (Bevill, 2013). Developers and builders with all levels of experience and expertise from around the country soon followed, establishing additional RV and mobile home parks and eventually constructing additional hotels and motels to alleviate the crisis (Dawa Solutions Group, 2013). Permanent forms of housing such as traditional single family homes and apartment buildings also slowly began to be constructed (Lombardi and Bruni, 2012), but only in limited quantities.

Using data for the number of newly licensed units by the North Dakota Department of Food and Lodging, a phased response to the housing shortage can be seen in Figure 1. McKenzie County shows a clearly discernible sequence in which during the initial stages of the oil boom in 2009 the housing shortage was alleviated primarily by additional RV parks. This phase was followed by licensure of a substantial number of mobile home park units in 2011. Mobile home parks experienced 500% growth in 2012 and then maintained that same level of growth the following year. Temporary work force housing (TWFH) was the third phase of housing to occur, experiencing tremendous growth in both 2012 and 2013. Although the hotel/motel industry appears to have commenced in line with the increase in TWFH, it was the last sector to experience significant growth.

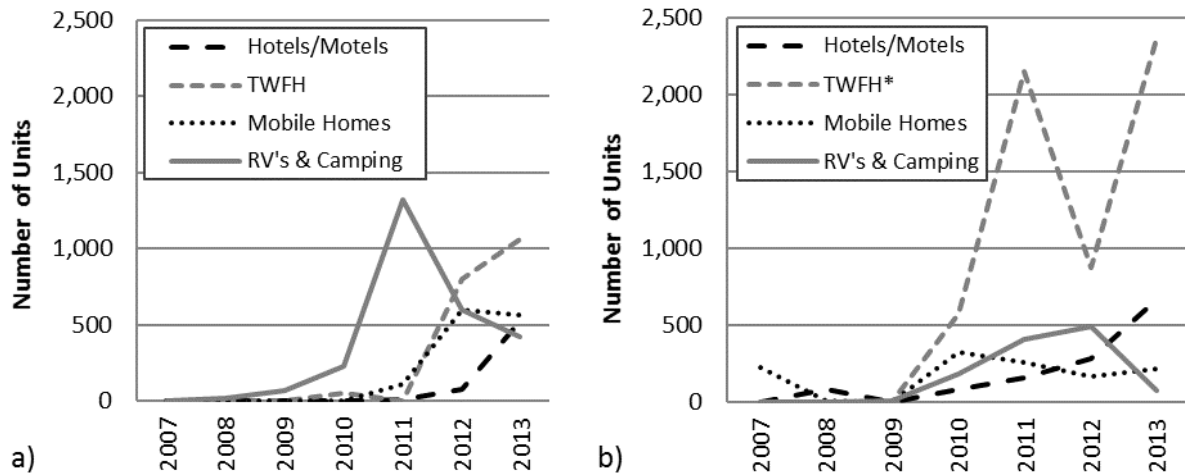


Figure 1: Temporary housing growth in a) McKenzie County and b) Williams County, ND.

In contrast, Williams County (the very epicenter of the oil boom) experienced a simultaneous increase in all forms of temporary housing in 2010, as seen in Figure 1. This simultaneous growth may be explained by the larger population that existed in Williams County prior to the oil boom, presumably supporting a larger number of permanent and temporary housing options. As the oil boom set in, the existing housing may have been able to absorb some of the initial demand, which then affected the sequential reaction of the temporary housing market. The hotel/motel industry once again started relatively slow before gaining traction in 2013, where more rooms were licensed than in the previous three years combined. For some reason TWFH experienced a significant decline in 2012, perhaps as a reaction to the simultaneous growth in all other areas.

Figure 2 depicts the anticipated need for temporary housing units in Williams and McKenzie counties, based on projections made by Bangsund and Hodur (2013). As shown, at some point between 2012 and 2013 the number of licensed temporary housing units surpassed the projected demand for such units in these counties. This sense of equilibrium in the Williston Basin has also been noted by companies that provide temporary housing solutions in the region (Bevill, 2013 and Sprnczynatyk, 2013). This may indicate that an oversaturation of temporary units was developing because more permanent options were becoming available. What affect would an oversaturation of temporary housing have on the region? The general consensus is that as workers remained in the region they would gradually transition into permanent housing, such as traditional single family homes (Herr, 2013). However, if the temporary housing market was oversaturated, it would most likely result in lower temporary housing costs, which in turn could further delay entry into the permanent housing market.

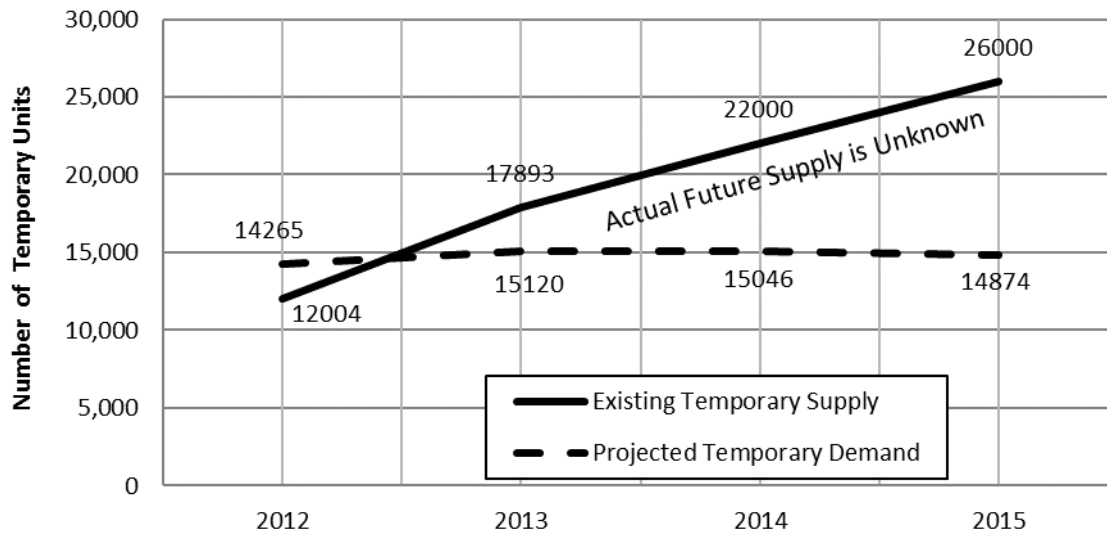


Figure 2: Temporary housing vs. projected demand in McKenzie and Williams County, ND.

Although there is some sentiment toward transitioning to permanent structures, it doesn't appear that temporary workforce structures will be going away anytime soon in the Williston Basin. Oilfield workers are generally single males working long and varied hours, sometimes 7 days a week. This combined with the highly elevated cost of housing has created a situation where traditional living arrangements are not practical, as most workers simply need a place to clean up, eat, sleep and communicate with family (Wanjek, 2013). As a result, "man camps," which are just one form of temporary workforce housing, have become an integral part of the solution to the ongoing housing shortage throughout the Bakken region (Bevill, 2013 and Kemmick, 2012).

During the described housing dynamics process, the value of the existing housing supply and other housing related property rapidly increased (Bevill, 2013 and Herr, 2013). These artificially high real estate values accelerated the commencement of traditional stick-built homes and multifamily units, as a speculative market was born. All forms of construction faced elevated labor and material costs due to competition with the easily available and high paying oilfield jobs (Davies, 2012). As a result construction costs rose dramatically. With the increase in real estate values, high cost of new construction and continued growth, rental rates for all forms of housing and lodging also increased considerably (Davies, 2012 and Nolte, 2013). Despite the high paying wages, some companies in the oil industry realized that their employees either couldn't find accommodations at all, or couldn't afford to pay the exorbitant rates (Bevill, 2013). The dynamics described continued to play out as large employers also started to explore the available housing options. Some companies resorted to purchasing single family homes in which to house multiple workers (Bevill, 2013). Others purchased entire apartment complexes, existing motels and other available resources (Davies, 2012 and Herr, 2013). One of the challenges for companies that did purchase large commercial properties was managing them, which proved difficult for companies not accustomed to acting in that role (Herr, 2013). It was at this point that companies specializing in housing, feeding and accommodating hundreds of workers in remote locations arrived and began constructing and operating man camps (Bevill, 2013).

Man Camps come in many different forms and can simply be described as temporary facilities that can house, feed and transport hundreds of workers at a time. Man camps come in a variety of forms, some of which consist of individual trailers or cabins. The individual units can be park model trailers, FEMA trailers, traditional mobile homes, modular units, or a hybrid of multiple construction methods. Other man camps consist of modular units joined together to form large conjoined structures, many of which include dining halls, laundry facilities, common

recreation areas and other amenities (Wanjek, 2013). Man Camps tend to either be privately owned by corporations which then exclusively lease or rent rooms to their employees, or managed by a private owner and leased out to the general working population with nightly, weekly, monthly, or extended stay rates. The camps owned by large corporations are often located in a centralized location in proximity to where the work is taking place (Irvine, 2011). In these instances they may be miles from stores, restaurants, entertainment, or any of the other signs of civilization. As a result, the camps must provide all the necessities, including cleaning services, security, fire protection capabilities, cable TV, internet service, and a sense of community (Rothaus, 2013). For many large companies the construction of a man camp has become the most reasonable way of housing their much needed work force.

Lessons Learned from Williston Basin Temporary Workforce Housing

The sudden need for workforce housing in the Williston Basin resulted in a variety of attempted housing solutions. As has been established in this paper, the existing housing resources were initially overwhelmed, subsequently followed by a rapid phased growth of temporary housing development. The remainder of this paper focuses on discussing some of the issues and unintended benefits surrounding the temporary housing increase that occurred during the housing crisis.

There were two forms of qualitative data gathering employed during this research, each a form of on-site fieldwork. The first method included conducting a series of unstructured personal interviews with dozens of people, including developers, property managers, contractors, homeowners, and government officials. Site visits and interviews occurred over a 15 month period between 2012 and 2013, at the peak of the housing crisis. Interviews were performed in conjunction with site visits of newly constructed temporary housing units, including formal inspection of 50+ units, 300+ walk throughs, and 1,000+ other units observed. This type of conversational interview was appropriate for this research, because it allowed the interviewer maximum flexibility to pursue information regarding lessons learned based on the immediate context of each unique site visit (Patton, 2002). The second method occurred simultaneously and included direct observation of the newly constructed units. This included witnessing the construction and development methods employed in both permitted and illegally unpermitted applications. Employing both of these methods allowed the researchers to use a grounded theory type approach and converge upon consistent themes and patterns (Patton, 2002). Therefore, these lessons learned incorporate a construction regulatory perspective based upon the personal interaction with the construction and development industry in three different western North Dakota counties. These lessons are presented in an effort to avoid similar mistakes as the housing crisis continues to play out, and providing useful insight for future housing crises.

Issues

1) **Lack of sufficient design work, engineering, site evaluation, and architectural plans:** Due to the limited availability of licensed professionals in the region, a common error on the part of developers and contractors was proceeding with construction without sufficient design work. Plans for proposed developments often never advanced beyond a conceptual site plan. The availability of professional engineers, surveyors, architects and contractors was extremely limited. Those that were able to secure professional services often resorted to out of state firms, who had little knowledge of the actual site conditions. Contributing to the problem was the lack of experience by those designing, managing, and financing the various projects. Many developers were unaware of the development and construction processes which spawned a variety of secondary problems which are later addressed.

2) **Construction overwhelmed regulatory bodies:** The sudden increase in population in conjunction with the massive growth in construction and development quickly overburdened the local jurisdictions. Many had not previously recognized the need for regulatory control through building codes, fire codes, planning and zoning or similar ordinances (Bevill, 2013). Local governments were understandably overwhelmed, understaffed and unprepared. The jurisdictions that were lucky enough to have established building departments, fire marshals, and planning and zoning departments lacked in-house expertise and capacity for the volume of work that had arrived seemingly over-night. A vast majority of local jurisdictions lacked regulatory departments altogether, and were left scrambling to maintain any semblance of control (Brown, 2013). Local jurisdictions did their best to keep up with the immense work load which often resulted in long delays, limited enforcement of regulations, unspecified construction time-lines or simply frustration. Some jurisdictions turned to third party entities to ease the growing pains, while others embarked in nationwide searches for skilled regulatory professionals. The construction process continued in spite of the delays, although the quality and level of code compliance may have suffered as a result.

3) **Lack of available utilities and infrastructure:** As could be expected in a construction boom, the local infrastructure including water, sewer, electricity, phone and internet access could not feasibly keep up with the pace of growth (Nolte, 2013). Possibly as a result of the lack of long-term planning from a zoning perspective or due to the inexperienced and often impatient developers, consideration for the availability of such necessary resources was not taken into account. Some projects sat fully complete, but unoccupiable due to a lack of essential utilities such as power and electricity. Local utility providers were faced with the demand for millions of dollars of infrastructure, with no long-term guarantee of a population to support and pay for such improvements (Davies, 2012 and Macke and Gardner, 2012). In some instances moratoriums on building in certain areas were put in place (Bevill, 2013).

4) **Poor site selection:** As both permanent and temporary development sites were selected, a lack of forethought regarding proximity to the necessities of life occurred. In part due to the lack of urban planning by the local communities, development often took place in islanded pockets which lacked easy access to gasoline, groceries, banks, restaurants and entertainment (Wanjek, 2013). In the frenzied development environment, affordable real estate was gobbled up with little or no analysis of matching a project to a parcel of land. As a result, projects were crammed onto odd shaped parcels, large amounts of earthwork were often required, and access to roads and highways was often limited. Due to the immense demand for housing, these types of developments seem currently viable. However, as demand wanes, the population will seek housing that is more conveniently located. The long term effects of poor site selection are not yet known, but could result in limited long-term viability.

5) **Lack of skilled construction workers:** Construction deficiencies were commonplace due to factors such as the haste of construction, adverse weather conditions, as well as the lack of experience, licensure of contractors, proper regulatory controls, long-term relationships with clients, skilled labor, and so forth. As a result, not all buildings performed as designed, suffering settlement, or wind or fire damage. Due to the high paying oil field jobs, construction workers proved difficult to find and retain (Davies, 2012). Contractors were forced with either paying increased wages or using less skilled and qualified workers. The latter proved both economical and common.

6) **Inexperience with the severity of the climate:** Workers from around the country quickly became subject to the Bakken region's extreme winter temperatures. Despite warnings from local residents, construction projects were slated for year-round schedules. These accelerated schedules were not always feasible due to the decreased productivity during extreme cold. Excavating, concrete pours, and all forms of construction work simply were not possible at times. Many construction workers accustomed to warmer weather from places simply could not handle the cold and left the area (Davies, 2012). Had developers and contractors truly understood the impact that the climate would have on their proposed projects, better planning and scheduling could have taken place.

7) **Unfamiliarity with modular and manufactured construction:** With local labor costs driving up the price of construction, contractors soon turned to the concept of modular and prefabricated units. The cost savings involved using cheaper labor in remote locations, which were not subject to the regional economic conditions. In addition to the labor cost savings, materials were more readily available and could be purchased at a reduced cost. The modular concept in current construction practice is generally seen as a positive due to increased productivity, higher quality, etc. However, in this application modular construction was often not effective, primarily stemming from a lack of prior knowledge and expertise by the contractor, subcontractor, local regulatory bodies and customers.

8) **Poor understanding of worker needs:** Even the experienced developers and contractors regularly failed to understand the oil industry as a whole. The workers who would occupy the many residential accommodations had specific needs that were not always taken into consideration. For example oilfield workers regularly arrive home dirty and many of the units lacked a place to clean off prior to stepping inside. Some developments only had limited cell phone and internet service. These services have now become necessary in carrying out business, specifically when no other form of communication is in place. The oil field workers are primarily living remote from family which further exacerbates the problem. In addition to the day to day needs, the type of developments didn't match the transitioning needs of the workers who occupied temporary housing. Many arrived alone but once established began bringing their wives and children to the area (Bevill, 2013). Although a large number of temporary housing options had been constructed, few were suitable for a family. Man camps, FEMA trailers, and small hotel and motel rooms lacked the space and functionality required to accommodate a family. Adding to the problem was the fact that the boom coincided with an economic recession (Nolte, 2013). Many workers who relocated to the Bakken were trying to rebuild following financial distress. The appeal of new single family homes was muted due to lingering credit issues (Bevill, 2013).

9) **Disregard for environmental impact:** The drastic economic growth has come to the Bakken region often at a high environmental cost. There have been many instances of sewage being dumped along back roads, in wetland areas, and elsewhere. The fracking fluids themselves have been purported to contain carcinogens and other toxic substances (Mayda, 2011). The impact on the environment cannot be fully measured at this point. Long-time residents have also voiced concerns that the oil industry will deplete or pollute their aquifers, due to loop-holes in the law exempting them from provisions of the Safe Drinking Water Act (Dobb, 2013). Surprisingly public outcry for improved environmental protection is minimal (Brown, 2013). It appears the perceived economic benefits and the realization that there will be an eventual bust keeps a majority of the environmental critics at bay.

Unintended Benefits

1) **Reuse of FEMA trailers:** The resourcefulness of developers and other entrepreneurs was made apparent as hundreds of new and used FEMA trailers were repurposed for temporary housing in the Williston Basin, and elsewhere. Roughly 145,000 FEMA units were used in hurricane Katrina relief efforts and then eventually sat in surplus at various locations around the country. Over a six-year period 130,000 units were sold at auction for pennies on the dollar (Watson, 2010). Although there is no official count regarding how many of these trailers ended up in the Williston Basin, the oil boom proved to be a fortunate opportunity to put to use many of these units in providing a rapid response to the housing crisis, and at minimum delayed their disposal into landfills.

2) **Increased use of new energy efficiency measures:** The new construction associated with the housing boom is currently built to the standard of the 2009 International Energy Conservation Code (IECC). As the new housing stock becomes available it will gradually replace the older housing stock which was typically built to less restrictive energy requirements. Although the overall energy demand will increase with the increase in population, the amount of energy consumed by each individual dwelling unit should decrease. Most homes in existence prior to the boom were built long before 2003, likely in accordance with substantially less efficient standards. Some temporary work

force housing facilities incorporated additional energy and resource saving measures, such as metered faucets, as well as recycling programs (Sprynczynatyk, 2013). Many temporary facilities minimize square footage per occupant. Modular structures decrease the percentages of exterior walls, when compared to stand-alone units, thus resulting in better energy efficiency. Although the source of the boom is generating additional fossil fuels, the effort to decrease the use of such fossil fuels is ironically apparent.

3) Temporary housing minimizes impact on permanent housing market: As a result of the widely available temporary housing options, a majority of the new work force was kept out of the permanent housing market. In the Williston Basin an additional 15,482 temporary housing units were licensed between '08 and '13, while comparatively the total demand for permanent housing at the end of that period was only 19,885 (Bangsund and Hodur, 2013). The permanent housing market was unable to meet the demand that existed, and had the entire population sought permanent housing, the housing crisis would have been compounded. Increased demand would have further increased permanent housing prices as well as construction material and labor costs. These inflated costs do not equate to increased material value, which sets up the market for failure once the demand is satisfied. Temporary housing protected a large number of people from entering the permanent market during the peak of elevated costs. Now that the data suggests that the supply of temporary housing is reaching an equilibrium, housing values may decline if equilibrium can be maintained. Housing values should start to approximate their actual material values which may help prevent a housing market collapse in the event of an oil bust.

4) The reuse and potential reuse of temporary housing units: Often the stimulus of innovation is necessity. The housing crisis spurred the minds of many people who were looking for potential solutions. One such innovation was the Muddy River Lodge which involved the reuse of a mobile complex originally used at the 2010 Winter Olympics in Vancouver (Klimasinska, 2013). The ability to construct and utilize housing in one location to meet a demand, which can then be deconstructed and repurposed for use in another location experiencing similar demand is indeed innovative. Hopefully this same type of repurposing can take place with the vast number of temporary units currently involved in the current oil boom. Once all of the drilling rigs and temporary workers leave, an overabundance of permanent housing will not serve the public well. The potential for such relocation and repurposing of temporary housing units justifies its continued and expanded use, despite the perceived drawbacks.

5) Resulting “legacy infrastructure” provided to local communities: One result of increased development in the Williston Basin has been the construction of additional infrastructure. Miles of roads, electrical distribution lines, water lines and associated utilities have been constructed that otherwise would have served little purpose, and could have never been financially justified. In one instance a large temporary housing facility constructed a wastewater treatment facility, which is one example of what the developer refers to as “legacy infrastructure” (Sprynczynatyk, 2013). Although the challenge of ultimately paying for and maintaining such infrastructure exists, the potential economic impact of these newly available resources is substantial.

Conclusions

The oil boom and subsequent housing crisis in the Williston Basin has resulted in an increased awareness of the housing challenges associated with sudden population growth. Not unlike the California gold rush or Hoover Dam construction of the past, the demand for housing is always eventually satisfied. The challenge of such sudden growth is being able to predict its dynamics, and to avoid costly mistakes. The manner in which a region responds to a housing crisis is largely market driven. The existing supply of housing and size of the local population affects the dynamics of the temporary housing response. A larger population appears to provide more elasticity to the market, enabling a more varied response. Regardless of population size the temporary housing dynamics follow the same general sequential pattern, including first exhausting existing housing options, and then growth occurring in RV parks, mobile home parks, temporary work force housing, and then finally hotels and motels. Temporary housing plays a necessary role in providing an immediate response to a housing shortage, and also serves as a permanent part of the solution as oil booms and housing crises play out. Understanding this cycle is important for developers and contractors, etc., as they seek opportunity in developing both temporary and permanent housing solutions.

As has been discussed throughout the paper the surge of population in the Williston Basin has fostered a myriad of potential lessons for the construction and development industries. Mistakes were the result of multiple interrelated issues, some of which could have easily been avoided while others were the circumstantial results of a unique situation. Despite the many mistakes, there were also many unintended benefits. Both the issues and benefits serve as valuable tools for continued growth in the region, in addition to future housing crises around the world. The potential solutions require first simply understanding what the issues are, as explained within this paper. This brief case history provides a number of educational opportunities for students to discuss challenges associated with rapid population growth. For instance, students in a project management course could discuss the challenges associated with managing a construction project in this region, or perhaps how to manage risk in this construction environment.

Additional research is needed in understanding what effects existing and new permanent housing has on temporary housing dynamics. Predicting an oil boom in advance is nearly impossible. This leaves the concept of preparing for a future housing crisis nearly impossible, meaning future housing crises are inevitable. However, the goal is not to prevent future crises, but rather to respond in a responsible and strategic manner. Understanding the dynamics of temporary housing associated with a housing crisis also increases the odds of such a response.

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