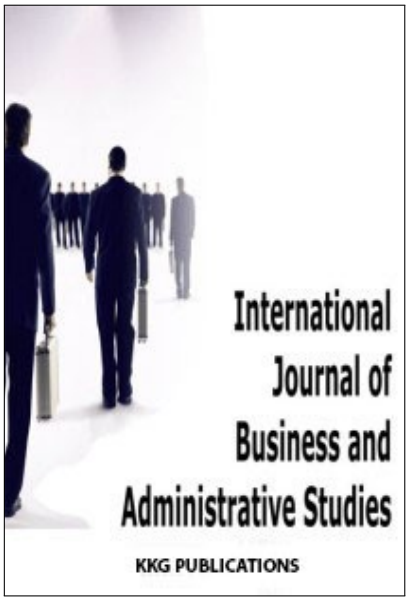

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Published online: 05 December 2015

To cite this article: Challenor-Bevis, M. (2015). Fly-in Fly-Out (FIFO) accommodation in remote regions: How can good design help?. *International Journal of Business and Administrative Studies, 1*(4), 155-164.
DOI: https://dx.doi.org/10.20469/ijbas.10004-4

To link to this article: http://kkgpublications.com/wp-content/uploads/2015/12/IJBAS10004-4.pdf

International Journal of Business and Administrative Studies
2015, 1(3), 155-164

IJBAS

FLY-IN FLY-OUT (FIFO) ACCOMMODATION IN REMOTE REGIONS: HOW CAN GOOD DESIGN HELP?

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Keywords:
Fly-In Fly-Out Workers (FIFO) Built Environment
Health and Wellbeing
Long-Distance Commuting (LDC)

Received: 20 March 2015
Accepted: 18 May 2015
Published: 05 December 2015

Abstract. This paper explores how urban design principles can be applied to FIFO accommodation camps. A template is adapted from Mark Francis' Landscape Architecture method and was used as a structured observation schedule to qualitatively assess operating FIFO camps in regional Western Australia and other similar living environments. Observational fieldwork was undertaken at the FIFO camps, including site visits, semi-structured interviews, participant observation, and photography. This paper reports on four of eleven lessons learned from the research. The findings discussed are aesthetics, site selection; safety and hygiene; and legibility of the camps. This paper proposes that quality urban design strategies can be applied to all developments where people live and work, not just cities. The precedent of erecting temporary accommodation modules during commodity 'boom' periods and construction phases with the unfulfilled intention of developing the site for operations staff often falls short of workers' health needs. This practice can leave skilled workers living in dilapidated and unsafe dwellings in contrast to corporate expectations that require workers to be highly productive and effective during 24/7 operations. As resource extraction becomes increasingly geographically remote, the use of FIFO workforces will likely increase, therefore potentiating improved living environments. The research suggests that the FIFO living environment lacks cohesion, and improvements in camp design may promote workers' health and well-being. The paper contributes to the growing body of knowledge about how FIFO work impacts the FIFO workforce.

INTRODUCTION

Ore bodies rarely coincide with the human resources necessary for their exploitation, nor are many left which occur in temperate regions, or indeed in association with other resources which can generate alternate employment opportunities. The climate, the isolation, the paternalism of company towns, the exploitive and transitory nature of the industry, generate conditions conducive to sociological crises. (Howroyd, 1974, p. 53).

Australia's FIFO workforce continues to be in a state of 'sociological' crisis (Howroyd, 1974) and as such the Australian Federal Government's House of Representatives Standing Committee on Regional Australia launched an Inquiry into FIFO work practices (2012). The recommendations provide a framework for research into these practices, but accommodating this unique workforce is underrepresented in the findings (2013). Following the 'Inquiry', a report by the Education and Health Standing Committee (2015) determined that FIFO accommodation camps are inadequately protected under current health and safety legislation. The report finds that the provision of accommodation for FIFO workers remains unregulated and that has led to significant differences in the standard of accommodation provided to workers during different phases of the resource cycle. Although construction workers can spend an average of two to three times more time on site than operations workers, the accommodation provided is often of a lower standard. Additionally, the practice of 'motelling', which refers to worker room sharing arrangements, can lead to workers feeling isolated, lonely and disconnected from a sense of place. The report found that practices which remove permanency from an individual's accommodation arrangements do constitute a health and safety risk which may contribute to mental health problems. The report also found that the prevalence of mental health problems in the FIFO workforce is significantly higher than the national average and recommends a Code of Practice that addresses FIFO work arrangements and their impacts on employees' mental health (2015, pp. 19, 31, 47, 82-89, 93). It is for these reasons that this research may contribute to improvements in the accommodation arrangements of FIFO workers and the theoretical understanding of FIFO camps and their impacts on workers. Remote FIFO camps are unique temporary settlements. The duration of the settlement is determined by

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the expected life of the resource to be mined and therefore, by its very nature, the settlement is considered temporary. The problem of FIFO accommodation design is not one that is found in usual city design; that of limited physical space and a growing population.

The remoteness of mineral extraction lends itself to opportunities to create settlements that have few spatial boundaries. However, boundaries are important to human comfort and security (Appleton, 1975) so within defined boundaries, Brill et al. (1984) and the Commission for Architecture and the Built Environment (2004) found that good design may improve morale, boost productivity and respond to issues relating to turnover. The ideas that work in good city design can be used to design good remote location settlements even if they are classed as temporary. However, simply applying the ideas of good city design as is with no effort to respond to the remoteness of specific locations will likely result in "Outback Suburbias" (Sharma, 1983) that have been proven to fail (Aschmann, 1979; Brealey, 1982; Newton & Brealey, 1979). FIFO camps do not live and die by the same population-growth rules of cities. Therefore, in using good design ideas to help design better FIFO camps, the specificity of duration and location are more important indicators than the usual demographic indicators used in city design.

What is FIFO and Why it is Important

Australians use the term 'FIFO' loosely to describe a person who works in the mining or oil and gas industries. FIFO refers to an employment model; workers fly in to their place of work, work for a predetermined number of days on site and a predetermined number of day, night or rotational shifts, and then fly out to return to their place of origin or staging location. FIFO also refers to a type of workplace. For economic reasons, the site is (usually) mined for a period of time determined by the size of the ore body and the technology available to extract it. The mine is operable 24/7 and 365 days a year except in cases of planned maintenance shutdown. Additionally, FIFO refers to a type of worker. FIFOs are easily recognizable within the urban environment. Heading to or from the airport on their way to or from work they wear part of their Personal Protective Equipment (PPE) or uniform; the high visibility shirt is a sure sign that the person wearing it is a FIFO (Plate 1). Airports in resource rich states are full of FIFOs waiting for their connecting planes. They come from all walks of life and all manner of places. FIFOs sometimes travel international distances to get to and from work. When considering that a FIFO might spend more than half of their life on a work site, a FIFO camp changes from being temporary accommodation to becoming a second home.

FIGURE 1
Plate 1. FIFOs and their High Visibility Uniform

Source: (Woods, 2014)

In considering the life of FIFOs it is argued that FIFO work conditions and lifestyles are contributing to social problems and a lack of social cohesion in the workforce and associated population (Carrington, Hogg & McIntosh, 2011; Carrington & Pereira, 2011; Henry, Hamilton, Watson & MacDonald, 2013; McLean, 2012; Scott, Carrington & McIntosh, 2012). In addition to research about the psychosocial and wellbeing impacts of FIFO work there is a growing body of knowledge reporting on the health of the workers and the public health impacts of FIFO work (Joyce, Tomlin, Somerford & Weeramanthri, 2013) including international attention to similar "industrial camps" in Canada (Giesbrecht et al., 2012; Giesbrecht, Thibault, Zirul, Chapman & Hasleth, 2013). FIFO worker turnover rates are high and the costs to industry are not confined to recruitment and training, decreased productivity and reduced workforce skills, but also impact worker morale and workplace culture. Whilst industry tends to downplay the controversies surrounding the relatively new phenomenon of FIFO work, the research to date shows otherwise (Resource Industry Employer Group (AMMA), 2013; Resource Industry Training Council, 2010). Indeed, the problems related to industrial relations in the mining sector have been researched since the 1970s (Frenkel, 1978) and recent reports show that whilst the exploration and approval phases of the industry may be slowing, the need to continue using FIFO workforces will not (Education and Health Standing Committee, 2015; KPMG, 2013a, 2013b). The magnitude of the problems surrounding FIFO work cannot be addressed here and whilst a body of literature about remote Australian

mining settlements exists (Allen, 1982; Brealey & Newton, 1979; Holmes, 1988; Newton & Brealey, 1983) and research shows that FIFO camps are more cost effective than mining towns (Graham, 2000) there is a gap in the research related to FIFO accommodation design. How is a FIFO camp built? What is the decision making process? What can be done to provide living environments conducive to productive work in remote and extreme climatic locations? These are some questions that research can tackle but it comes down to how the resource industry wants to spend its money. As industry moves towards good corporate citizenship in its quest for perceived sustainability it is hoped that this research will contribute to the industry's triple bottom line (Chamber of Minerals and Energy, 2005; Cheshire, 2010).

Historic and Economic Context

FIFO work practices have been used by the mineral resource sector since the mid-20th century (Houghton, 1993; Storey, 2001) and arose in response to a need to accommodate workers in remote locations. Different modes of transport to get workers to and from these remote locations are often described collectively as "Long Distance Commuting" (LDC). These are: FIFO; Drive-in Drive-out (DIDO); Ship-in Ship-out (SISO); and (Bus-in Bus-out (BIBO). In 2011/12 the Australian economy benefitted by around A$150 billion or 18% of its gross domestic product (GDP) from the resource sector (including minerals and petroleum products) and over 150,000 new jobs were created in the mining sector between 2003/4 and 2011/12 (Geoscience Australia & Bureau of Resources and Energy Economics, 2013). FIFO workforce statistics are reportedly inconclusive (House of Representatives Standing Committee on Regional Australia, 2013), however, the Australian Bureau of Statistics (2015) shows 218,000 people employed by the resource sector as of February 2015 down from its peak of 271,200 in August 2012 towards the end of the most recent resource boom (2015). Mine statistics are equally inconclusive, however, Geoscience Australia reports 421 operating mines as of February 2015 (2015). The lack of concrete nationwide data about the FIFO workforce has led it to be labelled a "shadow population" (House of Representatives Standing Committee on Regional Australia, 2013, pp. 28, 44), a category used in Canada to describe transient workers (Regional Municipality of Wood Buffalo, 2012). Australian resource companies prefer a FIFO employment model Economic factors such as the reduction in favourable taxation incentives since 1986; State-based planning problems relating to slow release of land and construction approvals; the projected life cycle of the resource; increasing costs of building and maintaining towns and infrastructure in remote locations; and global economic uncertainty provide the basis for this preference. Additionally, improvements in telecommunications and aviation technology have decreased the costs of recruiting a more diverse skilled labour workforce from far afield (Houghton, 1993; Storey, 2001).

The Australian resource sector subscribes to rigorous standards and codes for the public reporting and classification of mineral resources (JORC Code, 2012) however, it is regrettable that no such standards exist for the public reporting or classification of workers involved in the same extractive industries; although the recent parliamentary recommendation for a Code of Practice that deals with FIFO work practices may improve the current situation (Education and Health Standing Committee, 2015, p. 57).

METHODOLOGY

In this study the principles described in Creating Places for People: An Urban Design Protocol for Australian Cities (Department of Transport and Infrastructure, 2012). provided a framework for defining what good quality urban design is. Ethics approved fieldwork was undertaken at a group of FIFO camps which involved using an adapted case study template from Mark Francis' case study methods. During the site visits the author completed the template by observing the workings of accommodation camps during one regular day shift at each camp. The author interviewed on site staff and took photographs of the accommodation camps and found that good quality urban design was lacking. The same case study template was used to collect data from a group of non-FIFO sites that had similarities in accommodating people in remote and extreme climatic locations. The author concluded that good quality urban design, that provided beneficial human outcomes, were found at the non-FIFO case study sites and a set of lessons were derived that could be applied to the design of FIFO camps. From this research eleven lessons were identified and four of these lessons are reported here. Although this paper describes improvements that can be made to FIFO camps, the lessons presented can be used in developing any new living environment, but especially those where people live and work.

Lessons Learned from the Case Studies

To define which urban design principles were most appropriate for use in FIFO camps, a group of remote settlements were compared using case studies. Of the seven case study sites chosen, four were FIFO camps and three of these were operating at the time of the study. The remaining non-FIFO case study sites constituted the Australian Antarctic Division (AAD) Research Stations, the mining town of Shay Gap, and the Bali Grand Hyatt. FIFO camps were studied to get a broad understanding of what constitutes a FIFO camp and how they are run. The

AAD Research Stations were studied because they represent a work environment in a geographically remote location that is also subject to extreme climatic conditions. Shay Gap, located in the north west of Australia, was studied because it was purpose designed and built to be a temporary mining town and is directly relational to the resource extractive industries. The resort was studied to provide a snapshot of one of the most luxurious forms of temporary accommodation. This case study provided insights about retaining civil society in a manufactured living environment, however these lessons will be discussed in future publications. Lesson 1: Aesthetics - when selecting the site, give preference to views of the surrounding landscape. Incorporate the settlement within the natural environment. Retain important pre-existing vegetation and landscape between dwellings.

Research shows that people prefer views of nature and that work and wellbeing is enhanced by providing natural rather than built views (see Farley & Veitch, 2001) and in line with Wilson's (1984) biophilia hypothesis, attention restoration (Berman, Jonides & Kaplan, 2008), the promotion of pleasant moods (Nisbet & Zelenski, 2011), and restorative health effects have been reported (Ulrich et al., 1991; Ulrich, 1984). On a mine site, workers may be underground or working in situations where views of the landscape are not possible during working hours. However, once their shift has finished, the opportunity to benefit from the impact of the surrounding landscape can be provided by situating the camp in an aesthetically pleasing location.

Aesthetic considerations are an important part of the design brief for a FIFO camp. Connecting with the landscape is something humans need to do even in extreme environments. During the rebuilding project of the Australian Antarctic Division Research Stations, a valuable sociological lesson was learned when a tunnel was built between structures at Casey (Incoll, 1980). Whilst the intention was to reduce the risk of fire when snow drifts restricted access to the buildings, the reality was that the expeditioners suffered from lower morale and "a form of cabin fever" (Incoll, 1990, p. 3). As soon as the tunnel was dismantled the cabin fever disappeared. It was apparent to the architect that regardless of the extreme climate, it was essential to the mental health of the inhabitants that they connect with nature (Incoll, 1990).

In choosing the site for the mining town of Shay Gap, the architectural firm, Lawrence Howroyd and Associates, used extensive site surveys to understand and work with the climatic and geographical challenges facing human settlement in the area. The site was chosen with the intention of protecting the settlement from the "Outback [that] has, besides flies, huge horizons; vast, unending, desolate, glaring, dusty unknown" (Howroyd, 1974, p. 54) and did so by using the existing topography and vegetation that formed a natural amphitheatre around the settlement (Plate 2). With temperatures exceeding 45 degrees Celsius for extended periods and average annual rainfall of only 113mm, situating the town within this amphitheatre of cliffs and mesas not only helped to protect the town from dust contamination from the mine site, but also provided the residents with a sense of enclosure from the harsh environmental conditions of the Pilbara. From a psychological perspective the post-occupancy evaluation of Shay Gap, commissioned by the US Army, noted that "the community of Shay Gap is a qualified design success" (Bechtel, Ledbetter & Cummings, 1980).

FIGURE 2
Plate 2. Aerial View of Shay Gap and Surrounding Mesas

Source: Howroyd

Lesson 2: Site Selection - situate the camp north or south of the mine. Using this site planning technique will ensure workers are not exposed to sun glare at shift change times at dusk and dawn. During shift change times, usually around 6am and 6pm, workers travel to and from the mine site to their FIFO camp. During these times, at dusk and dawn, workers are subjected to the full impact of the rising or setting sun if the camp is situated east or west from the mine site. It is also during these times that fatigue can play a role in road accidents (kerstedt, Peters, Anund & Kecklund, 2005; Monk & Folkard, 1992). Plate 3

shows an example of a FIFO camp situated to the east of a mine site. When workers finish their shift the rising sun will obscure their vision as they drive towards the camp. The same problem occurs when night shift workers are driving towards the mine when the sun is setting. The travelling time from this particular mine site to the FIFO camp is quite short, however the distances between mine sites and FIFO camps can be considerable. A safety measure in site planning to exclude the location of accommodation sites to the east and west of the mine could contribute to alleviating road accidents. At the least, it will contribute to the comfort of the workers as they arrive or depart the mine site.

FIGURE 3
Plate 3. FIFO Camp Situated East of the Mine

Source: First Quantum Minerals

Lesson 3: Safety And Hygiene - ensuring drainage is a primary consideration. Using stormwater management principles and high engineering standards will avoid runoff and soil erosion undermining structures and prevent health impacts associated with warm still water.

The easy way to quickly establish a new settlement is to clear the landscape, lay a foundation surface and erect pre-fabricated dwellings. The problems that arise from this procedure may not be seen immediately but will become apparent during extreme weather events such as storms, cyclones and associated flash flooding. Not only does removing established vegetation damage the ecosystem resulting in hardened soil that lacks water retention qualities, increases soil salinity, and promotes topsoil erosion; removing all vegetation from a potential settlement site immediately reduces the livability of the settlement and increases costs when it becomes necessary to re-vegetate the area.

Military garrisons are constructed on sites that have good drainage for the removal of effluent and to safeguard against flooding. The use of good engineering principles that are minimally compliant with recognized codes and standards is essential to the successful location of a FIFO camp. Poor drainage in lived environments can be the source of water borne diseases and promote mosquito infestations and blue-green algal blooms. Plates 4 and 5 show poor drainage in a FIFO construction camp that is now used as an operations camp, while Plates 6 and 7 show how rainwater runoff has eroded soil under buildings, undermining the structures and leaving them unsafe. In the same camp, the newer dwellings, or dongas , built for management, are located in an area with better drainage (Plates 8, 9 and 10). Some vegetation has been retained and the slope of the land is conducive to runoff.

FIGURE 4
Plates 4 and 5. Poor Drainage

FIGURE 5
Plates 4 and 5. Poor Drainage

FIGURE 6
Plate 8 and 9. Management Dongas Responding to the Natural Flow of the Land

FIGURE 7
Plate 10. Natural Slope of the Land

Lesson 4: Legibility - use bold colours on building exteriors to provide way-finding points and routes throughout camps.

After a 12 hour long shift, finding the way to your room should be relatively easy. Lynch's theories of "legibility" help us understand where we are and how to get from one place to another. He classifies physical urban forms into 5 elements and discusses how we use these recognizable cues to visibly identify and orient ourselves within a city (Lynch, 1960). The individual elements: paths, edges, nodes, districts, and landmarks don't "exist in isolation in the real sense. Districts are structured within nodes, defined by edges, penetrated by paths, and sprinkled with landmarks."

Plates 11 and 12 show how illegible the rows of dongas' facades look in a FIFO construction camp. In both the night and day images, there are no clear way-finding points to delineate between rows and amongst rooms. In contrast, images of the Australian Antarctic Division Research Stations (Plates 13, 14 and 15) show how using bold colours on building exteriors creates a legible and easy to navigate environment.

FIGURE 8
Plates 11 and 12. Illegible Rows of Dongas

FIGURE 9
Plate 13. Aerial of Mawson Station (photo: D. McVeigh)

FIGURE 10
Plate 14. Aerial of Casey Station

Source: © Australian Antarctic Division

FIGURE 11
Plate 15. View of Davis Station (photo: PH2010)

Source: http://www.antarctica.gov.au/about-antarctica/history/stations/davis

FIGURE 12
Plate 15. View of Davis Station (photo: PH2010)

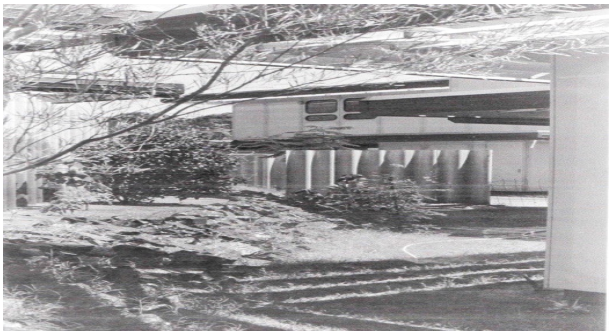
Source: Howroyd

In Shay Gap, although a late decision rendered all dwelling exteriors the same colour, two way-finding devices stand out as helping residents identify their own district. The first was to identify each of the ten-house 'precincts' using a "geometric shape and a colour, and each house with a number superimposed on its group graphic" (Howroyd, 1974, p. 55). The second device was to use the planting of a "secondary theme tree, usually in the medium-size range, and possessing some outstanding characteristic of flower, fruit, leaf or bark" (Technic 10 (WA) Pty. Ltd. & Crooks Michell Peacock Stewart Pty. Limited, 1974) to differentiate between 'precinct cells'. Both of these way-finding devices provided legibility amongst the groups of dwellings and amenity situated within an enclosing ring road (Plate 16).

CONCLUSION

The location of Shay Gap was chosen to give a sense of enclosure to the residents of the town. The ring road encircled the settlement within the cliffs and mesas to form 'Lynchain' edges. Disorientation was replaced with familiarity and by using theme trees in Shay Gap and colour-coded buildings in the Antarctic Research Stations, landmarks were created to enable people to easily navigate their way through districts. Landscaped paths in Shay Gap wound their way through districts to intersect at amenity nodes and helped shelter pedestrians from the climate (Plate 17). An added benefit of the aesthetics, legibility and site selection of Shay Gap was that neighbours interacted on their journeys along the paths, or walkways, that were devoid of cars, and children formed playgroups that were identified by their districts. The quality of a settlement is not only about the aesthetics and legibility of a place, but where and how it is built. A sense of value and pride in a living environment can be created by employing good site selection and engineering principles to ensure the settlement is safe and hygienic.

FIGURE 13
Plate 15. View of Davis Station (photo: PH2010)



Source: Howroyd

In each of the non-FIFO case studies the design intention was primarily concerned with creating a settlement where the health and wellbeing of the inhabitants is vital. In building FIFO camps, the case studies show that the primary consideration is to get workers on site quickly to extract wealth from the ground. While a FIFO camp is considered as temporary accommodation, the people residing there will be treated as temporary. A shift in perspective provides a view that a FIFO camp is where a FIFO worker spends (at least) half of their life, and that is far from a temporary situation; a FIFO camp is a home away from home. This research is limited to qualitatively reporting on the built environment of FIFO camps and comparing them with other remote and extreme climatic location settlements. Further research will include the post-occupancy evaluation of FIFO camps to better understand the impacts of the built environment on remote location workers.

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— This article does not have any appendix. —