



# DINCEL STRUCTURAL WALLING

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SUSTAINABLE CONSTRUCTION

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## WITH DINCEL CONSTRUCTION SYSTEM (DCS)

The world population is increasing rapidly.

Year	World Population
0 AD	0.2 Billion
1800	1 Billion
1950	2.4 Billion
Current	7 Billion
2050	12 Billion (estimate)

This rapid population expansion brings the following issues for basic human needs.

- **Building (for housing, work place, social needs).**

- Depleting natural resourcing for concrete making.
  - Dincel does not attempt to change Portland cement made concrete. Dincel's aim is to improve conventional Portland cement concrete with significantly less steel and cement use but making non-conventional materials such as mining rejects, coal, shale, clay, beach sand, corals, fly-ash and bottom-ash which are available in concrete making.
- Rapidly reducing skilled labour and construction safety concerns.
- Affordable construction; cost and time.
- Buildability in all conditions including flood affected areas, mine subsidence – bushfires – steep land zones, salty-acidic environments.
- Durability/longevity and maintenance free; 100 year life, crack – water damage free, no concrete cancer.
- Less emissions, embodied energy efficiency, less cement and steel.
- Sick building syndrome/indoor air quality.
- Fire safety.

- Structural strength; earthquakes/floods.

- Transportation.

- Protection of township by energy free flood levies or raising sea levels.

Dincel offers an overall solution to any of the above issues. The construction industry is still using the 5,000 year old bricks/blocks technology. These materials are no longer suitable for high capital outlay for establishment costs, high energy use and resultant CO<sub>2</sub> emissions, technical regulations (e.g. earthquakes) – cost – time – skilled labour availability reasons.

These are the main issues to challenge the construction industry. “Skilled Labour” in particular is already the biggest problem.

### FOOD SHORTAGE

The current global life span of harvest grain is 3 months. If this can be extended to the next harvest, say for 9 ~ 12 months life span, we can state that we have a solution in assisting worldwide hunger.

### WATER CONSERVATION

Design buildings and townships which can be self-sufficient with only 10% town-water top-up.

***Sustainability involves meeting the needs of today without compromising the ability of future generations to meet their needs for tomorrow.***

Sustainability is fundamentally about maintaining life on earth and the ecosystems required to support it. Thus, addressing human needs is a basic element of creating a sustainable society. Therefore, meeting human needs worldwide is one of the four TNS (The Natural Step®) system conditions. (<http://www.naturalstep.org/en/the-system-conditions>)

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In a truly sustainable society, nature is not subject to systematically increasing:

1. **Concentrations of substances extracted from the Earth's crust,**
2. **Concentrations of substances produced by society,**
3. **Degradation by physical means** and, in that society...
4. **People are not subject to conditions that systematically undermine their capacity to meet their needs.**

TNS provided the following comment:

***"The conclusion of this study by The Natural Step is that the Dincel Construction System (DCS) offers significant and compelling sustainability advantages for the construction industry. It has benefits over the traditional building technologies and is proven to work in practice."***

Refer for the above statement by TNS – Executive Summary in the following document ([Download – TNS Sustainability Study](#))

The construction industry plays a major role in improving the quality of built environment, but it also impacts on the under environment in a number of ways.

***The requirements for Sustainable Construction consist of the following main principles.***

1. Low embodied energy construction materials.
2. Responsible Development in the right place and in the right way.
3. Reduce construction waste and increased recycling.
4. Improved environmental efficiency and longevity of buildings.
5. A new food conservation construction technique
6. Local sourcing of key raw materials to reduce carbon emissions.
7. Ideal construction methodology to eliminate conventional shortcomings of the construction industry.

#### **(1) THE CONSTRUCTION MATERIALS**

The construction materials need to be fabricated using the following well known sustainability principles.

##### **(i) Reduce Material and Energy Intensity**

([Download – 7 Green Star for Your Next Project](#))

Refer **MATERIALS; PVC Use, Cement and Steel Minimisation.**

Dincel-Polymer production requires significantly less energy in comparison to other building materials such as cement, steel and aluminium due to its longevity.

Dincel Construction System (DCS) results with 42% immediate lower embodied energy use and 70% at the end of the building's life when compared to conventional construction incorporating columns and masonry infills. ([Download – Part 1 Energy Efficiency – Embodied Energy](#))

Dincel can also be recycled many times and therefore represents further lower total energy consumption.

Dincel prevents environmental decaying because of water and biological activities due to its rigid polymer enclosure and concrete core which forms an environmentally impermeable barrier. This eliminates the need for further material use as required for existing alternative constructions for such purposes, and again reduces the need for energy by simplifying the building procedure.

Dincel concrete-polymer matrix reduces energy consumption for heating and cooling, due to superior inherent insulation properties. ([Download – Part 2 Energy Efficiency](#))

Where Dincel Construction System is used as an engineering system, the following are achieved on behalf of energy efficiency. ([Download – Cost Saving Summary, Wall Comparisons and Risk Assessment](#))

The abovementioned material savings in steel, concrete and excavation represents **UNIQUE TOTAL COST, ENERGY, AND CO<sub>2</sub> REDUCTIONS** in comparison to conventional construction methods currently employed.

**Non Toxic Dincel Polymer Matrix incorporating non-toxic additives which result in extremely low Volatile Organic Compound emissions which are below current limits of detection.**

##### **Toxicity**

Dincel Concrete-Polymer matrix results in a reduction of carbon dioxide emissions in comparison to other common building materials and composites incorporating cement, steel and aluminium.

Dincel's rigid polymer-base consists of heavy-metal free stabilisers and non-toxic and plasticiser free ingredients exhibiting nil biological activity. All materials used by Dincel are approved by WorkSafe Australia. The end result is a material equal or better than the water and food grade polymer.

##### **• Indoor Air Quality (IAQ)**

IAQ in buildings is achieved or SICK BUILDING SYNDROME is eliminated if water, moisture, external pollutants and pests are prevented from entering building interiors. External pollutants may consist of particulates, gasses (volatile organic compounds – VOC) and biological pollutants. ([Download – Indoor Air Quality, Condensation, Mould and Mildew](#))

([Download – Leaky Buildings – Are Fibre-Cement Sheets Suitable](#))

Dinzel Construction System forms an air, water and pollutant impregnable barrier which consists of a virtually VOC-free (below detection level) polymer encapsulation system for concrete wall construction. ([Download – VOC Emission Test Certificate](#))

#### **(ii) Enhance Recyclability**

Dinzel's waste-residue and any off-cuts which may occur during manufacture and construction is 100% recyclable. ([Download – FAQ, Answer No: 3 – Recyclable/Sustainability](#)). A simple fact is that the material is too valuable to send to waste management or land-fill and is readily recycled into other longevity product applications. The permanent polymer enclosure eliminates the need for steel reinforcement for concrete crack control purposes.

This unique property of the material allows the complete recycling of the concrete-polymer product by allowing separation of the polymer enclosure from the concrete at the end of the building's service life.

The recovered polymer material may be re-used again and again.

Dinzel's in-built service spacers eliminate the need for conduits for electrical and communication cables; hence, the power/communication cables can be easily removed from the wall to assist with the recycling of these materials separately.

Dinzel also has a large potential to significantly reducing the use of wood products as formwork in the construction industry, by providing increased sustainable longevity.

#### **(iii) Maximised Use of Renewable and abundant Resources**

Dinzel-Wall system is derived from some of the most abundantly available raw material building-blocks on the planet, namely concrete (water-cement-sand-rock) and Dinzel-Polymer (chlorine, ethylene gas, ground limestone). The chlorine is extracted from rock salt or sea water. Ethylene gas is produced from ethane, extracted from crude oil, natural gas, and eventually perhaps sugar cane, etc.

#### **(iv) Extend Product Durability and Longevity**

The majority of buildings are being built by using concrete and reinforcing steel. The building perimeter walls, including basements are the barriers against environmental degradation of the building itself. The building perimeter walls finish their useful life sometimes much earlier than expected because of building joints, cracks, water and termite damage.

Dinzel, as a permanent membrane system encapsulating concrete accordingly prevents external contaminants with water, moisture, biological pests and termites entering into the building environment, thus eliminating environmental decay.

Authorities agree that if perfect conditions were provided, the life of concrete would be 50,000 years. Dinzel-Polymer forms an environmentally indestructible protection barrier around the concrete. No horizontal reinforcing steel bars required at Dinzel-basement and Dinzel-façade walls. The barrier eliminates steel reinforcement corrosion and concrete degradation even under salt and acid attacks. DCS would easily extend the life of the building walls which protects the building itself at least to 100 years.

([Download – FAQ, Answer No: 6 Life/Sustainability](#))

([Download – Waterproof Walls](#))

### **(2) RESPONSIBLE DEVELOPMENT TO BE PLACED IN THE RIGHT PLACE AND IN THE RIGHT WAY**

#### **(i) Water resources for urban settlements are important**

The patented system incorporates a radically new approach to metropolitan water conservation, in which the construction itself is used for rain water storage. The latter is achieved by creating a box foundation structure which becomes a water storage tank. Placed under the basement which is usually below the public infrastructure level, say, a low or high rise housing development, the storage unit will provide water usage of up to 90% self sufficiency.

([Download – Water Conservation](#))

The system has the potential of reducing the need for the construction of additional dams, cost and maintenance of public stormwater infrastructure, the reliance on the town water supply, significant reduction in lifting the restriction on the developable land areas.

#### **(ii) Re-use previously developed sites rather than extending into rural areas and develop locations already served by transport, communication and utilities infrastructure.**

Urban sprawl rather than consolidation and re-use of existing sites are costly and use significant valuable resources. The existing urban development sites could possibly be already contaminated from previous commercial/industrial usage.

Traditional construction methods tend to increase pollution risk from contaminated development sites by means of stormwater drainage and possible transportation of the excavated soil. Dinzel-Wall consisting of impervious polymer protection offers 100 plus years life in ground conditions as an environmental protection barrier against the spread of contamination beyond the development's site boundaries. This ensures that contamination is permanently encapsulated and possibly no excavated soil is removed from the construction site if regulations are formulated so that the development's feasibility is not compromised, especially for heavily contaminated lands.

DCS Water Conservation ensures that the public stormwater system is not utilised to spread the pollution from a contaminated site.

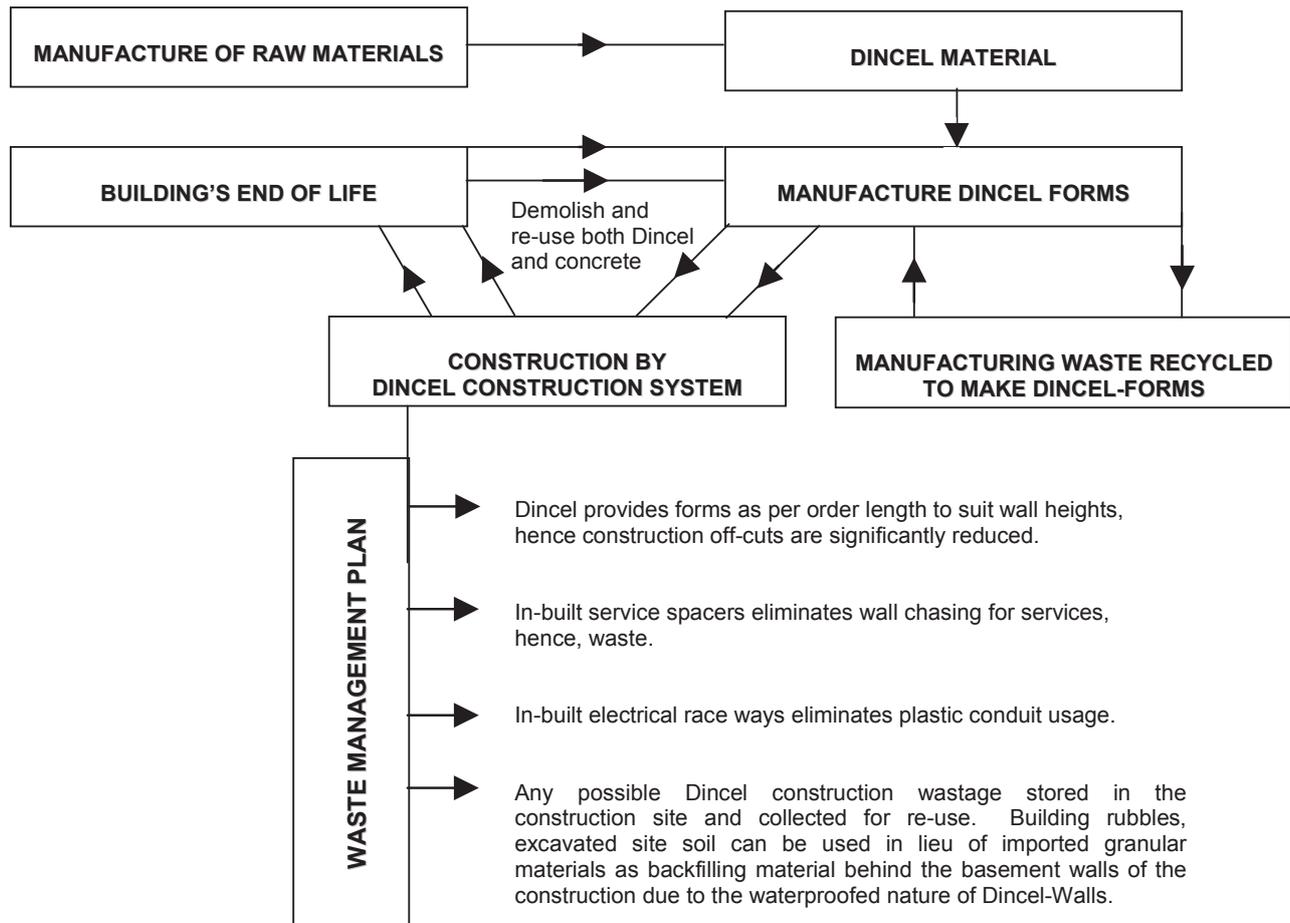
### (3) REDUCE CONSTRUCTION WASTE AND RECYCLE

Proposals by policy makers include the following to minimise the construction waste.

- (i) Developers to prepare written "Site Waste Management Plans" to identify the type and volume of construction waste. The measures to be implemented to minimise construction waste.
- (ii) Implement policies with a fixed percentage of reclaimed materials used in construction. This will force developers to create waste and prevent the use of construction materials waste.

(iii) Landfill Tax.

Dincel Construction System maximises the recyclability during manufacture, construction and end of life cycle. [\(Download – FAQ, Answer No: 3 - Recyclable/ Sustainability\)](#) Majority of the system is without steel bars so it can be crushed easily even with today's technologies. The crushed concrete and Dincel-Polymer can be recycled for a number of end of building life cycle times.



#### (4) IMPROVED ENVIRONMENTAL EFFICIENCY OF BUILDINGS

Requirements by policy makers.

- (i) **Water Efficiency** – Water must be used efficiently in buildings. Water harvesting is now mandatory, however unless Dincel Water Conservation is implemented, the available water harvesting quantity will not be adequate for current and especially for future usage. ([Download – Water Conservation](#))
- (ii) **Planning requirements to reduce energy usage for heating and cooling.**

The Australian Building Authorities (Sep65 Ruling) requires architectural plannings and material specification to reflect the above requirements.

- **Solar access** – north facing architectural designs for light and heating during the winter period.
- **Cross ventilation** – to reduce cooling requirements during Summer time.
- **Usage of energy efficient façade walls for both cooling and heating:**

With increasing concerns about global warming because of emissions from energy production, there are increasing demands for buildings to have efficient construction material usage for heat/cold provisions.

The factors affecting the energy performance of a façade wall are thermal bridging, air tightness and thermal mass. The combined effects of these factors are generally not considered when comparing the thermal performance of a wall system. Normally, a simple R-Value is quoted.

Dincel-Wall eliminates thermal bridging, provides waterproof and airtight vapour barriers at each face of the wall and offers significantly high thermal mass.

- **Construction Methodologies** resulting with lower embodied energy use. As demonstrated in ([Download – Part 1 Energy Efficiency – Embodied Energy](#)) Dincel Construction System offers 70% energy efficiency.

#### (iii) Workplace Safety

- Safer building construction

([Download – Dincel Solution for Construction Safety](#))

([Download – Dincel Solution for Construction Problems](#))

Installation work takes place at heights below 1.8m. Each 3m length module only weighs 13 kg and wall modules are delivered to site in pre-ordered lengths. Therefore, accidents due to the fall of labourers from heights, heavy lifting or conventional formwork with sawing and hammering are eliminated.

This system does not require reinforcement bars for the majority of the walls and the pre-ordered wall lengths and in-built services spacers eliminate off-cuts and wall chasing and hence rubbish generation. Accordingly, accidents due to reinforcement handling and wall chasing are significantly reduced.

The wall modules are installed mostly using battery operated drills, and consequently, incidents due to the electrocution of workers is significantly reduced.

The simplicity of the snap-on installation methodology, light material weight with no need for cutting or hammering reduce the installation time significantly. installed Dincel-Wall at the rate of 1m<sup>2</sup>/man/minute.

The system is most suitable and supported by the Australian formworking trades. The reasons are explained in ([Download – Formworkers Benefit](#))

- Safe Building Material Use

([Download – Dincel Solution for Construction Safety](#))

([Download – Indoor Air Quality, Condensation, Mould and Mildew](#))

The system prevents external contaminants, water condensation, moisture, biological pests and termites entering the building environment hence provide better working and living conditions.

#### (iv) Fire Resistance

##### Reduction Of The Risk Of Damage Due To Fire

Dincel's polymer consists of non-toxic additives, heavy metal free stabilizers and plasticizer free ingredients. This system has been tested by CSIRO (Commonwealth Scientific and Industrial Research Organisation) and specified as Group 1 in accordance with Specification A2.4 of the Building Code of Australia in which the product has no fire limitation for its usage. Its smoke characteristics is better than the minimum Australian Standards.

Dincel-Forms, when filled with concrete offer four (4) hours fire rating. Refer ([Download – Dincel Wall Fire Assessment](#)) and ([Download – Building Code of Australia Compliance and Certification](#)) for further information.

## (5) FOOD CONSERVATION

One of the most important items of sustainability is longevity of food stocks. Sustainable construction by Dincel Construction Systems offers the following solution.

In most countries grains are among the most important staple foods. However, they are produced on a seasonal basis, and in many places there is only one harvest a year, which itself may be subject to failure. This means that in order to feed the world's population, most of the global production of maize, wheat, rice, sorghum and millet must be held in storage for periods varying from one month up to more than a year. Grain storage therefore occupies a vital place in the economies of developed and developing countries alike.

The main function of storage in the economy is to even out fluctuations in market supply, both from one season to the next and from one year to the next, by taking produce off the market in surplus seasons, and releasing it back onto the market in lean seasons. This in turn smooths out fluctuations in market prices. The desire to stabilise prices of basic foods is one of the major reasons why governments try to influence the amount of storage occurring, and often undertake storage themselves.

Storage with Dincel Construction System reduces the following:

- Significant reduction in construction time and cost of storage facilities including structure and mechanical facilities.
- Maintenance and supervision costs for both grain and storage facilities.
- Loss of quality and nutritional value of grain by keeping the grain insect-free and below its safe moisture content and temperature.

Most importantly Dincel Construction System increases the vital storage life of grains significantly. ([Download – Storage Tanks/Silos For Grains/Liquids](#))

## (6) LOCAL SOURCING

The use of locally sourced raw materials, local labour, training, design and creativity should be maximised to support local economies and minimise energy use in transportation/travel is another basic principle of sustainable construction.

Dincel Construction System's (DCS) manufacturing plant has been designed to service local centres with a population in the vicinity of 500,000 with 1% population increase per annum. DCS employs local labour force and supports the local economy.

The local manufacturing of DCS eliminates significant storage space, transportation costs and eliminates substantial wastage as the product is manufactured at per order length to suit each and every project.

## (7) IDEAL CONSTRUCTION

There are many definitions of sustainable or in other words ideal construction. Dr John Duncan, Manager of the Building Industry Research, BRANZ defined the ideal construction material and system in the following documents:

- An International Agenda For Better Construction. [www.ce.berkeley.edu/~tommelein/CEMworkshop/Duncan.pdf](http://www.ce.berkeley.edu/~tommelein/CEMworkshop/Duncan.pdf)
- Innovation In The Building Sector – Trends And New Technologies (March 25, 2002). [http://www.branz.co.nz/cms\\_show\\_download.php?id=161](http://www.branz.co.nz/cms_show_download.php?id=161)

The needs of the international community raised in the following are highlighted questions by Dr John Duncan for the building sector.

### (i) Faster Delivery

[\(Download – Why Dincel is Faster to Build\)](#)

[\(Download – FAQ, Answer No: 3 – Faster/General\)](#)

### (ii) Zero Defects

The factory made precise size of DCS forms with snap-together connections are delivered as per order lengths can be formed even by non-skilled labour. Skill is required to keep vertical and horizontal alignment of the forms at the top which is easily achieved by the presence of formed decks installed by the formworking trades. The concrete poured in accordance with the recommendations stated in DCS Construction Manual achieves near enough to zero defects for the finished product.

### (iii) Reduced Operating, Maintenance and Energy Costs

DCS offers air and vapour barriers on faces, no thermal bridging or thermal mass which reduces heating and cooling requirements hence less energy use. The crack/joint free, waterproof and termite free DCS eliminates maintenance costs associated with water, moisture, cracks, termites and pests. ([Download – Part 2 Energy Efficiency](#))

### (iv) Greater Durability and Flexibility

200 Years life, durability problems of concrete is eliminated, no corrosion, no concrete cancer even in salinity conditions. The most abundant construction material concrete, behaves in a ductile and non-brittle manner because of Dincel's permanent polymer encapsulation which is the solution for earthquakes and hurricanes.

[\(Download – FAQ, Answer No: 6 – Life/Sustainability\)](#)

[\(Download – Waterproof Walls\)](#)

[\(Download – Sustainable Concrete\)](#)

#### **(v) Greater Building User Productivity and Comfort**

Volatile organic compound (VOC) free, non-toxic material does not support fungi, bacteria growth and is termite proof. Its thermal mass and vapour barriers regulate climatic conditions thus thermal comfort and cleaner air is offered for productivity and comfort.

#### **(vi) Fewer Building-Caused Illnesses and Injuries in the Construction Industry**

Fire safe (Group 1 material), smoke criteria is less than the Building Code of Australia (BCA) requirement. Non-toxic and inert, does not support sick building syndrome. Waterproof, eliminates/reduces moisture related issues and accidents.

[\(Download – Indoor Air Quality, Condensation, Mould and Mildew\)](#)

[\(Download – FAQ – Answer No: 4 – Safer/General\)](#)

[\(Download – Dincel Solution for Construction Safety\)](#)

#### **(vii) Less Waste and Pollution**

Product supplied to the construction industry as per order length so that majority of construction wastage is eliminated.

No construction waste during manufacturing, thanks to the innovative manufacturing technology. All wastage, off-cuts, etc. are automatically recycled and placed back into manufacturing.

The system eliminates the need for crack control steel reinforcement use in concrete walls and as a result after a minimum of 200 years of construction, Dincel-Walls can be easily crushed (even by today's technology), concrete aggregate and Dincel-Polymer can be further recycled.

[\(Download – FAQ, Answer No: 3 – Recyclable/Sustainability\)](#)

#### **(viii) The abovementioned items to be Achieved in the Most Cost Effective Manner**

##### **Building Affordability**

###### **• Land Cost**

- Building plannings require solar access for the purpose of energy efficiency. DCS significantly reduces the need for solar access which in turn will increase the developable land area, thus reducing land cost.

[\(Download – Information for Architects\)](#)

- The availability of Dincel's water conservation system reduces the land cost by lifting the restrictions due to water scarcity or flooding on developable land areas.

[\(Download – Water Conservation\)](#)

- Significant land masses lost to sea erosion can easily be reclaimed at very minimal cost.

- Re-centralised raw land developments require very expensive infrastructure cost which naturally reflects land cost.

###### **• Building Costs**

There is no other comparable wall system that can match Dincel-Wall in the cost effectiveness, speed, structural efficiency, flexibility, waterproofing, crack, joint and termite damage free.

[\(Download – Information for Architects\)](#)

[\(Download – Dincel Solution for Housing Affordability\)](#)

[\(Download – Cost Saving Summary, Wall Comparisons and Risk Assessment\)](#)

[\(Download – Costing Analysis\)](#)

[\(Download – Why Dincel is Faster to Build\)](#)

[\(Download – FAQ, Answer No: 3 – Faster/General\)](#)

# SUSTAINABLE AND AFFORDABLE HOUSING FLOW CHART

