Recycled aggregates - environmental considerations

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Outline

- Resourceco case study – recycling aggregates in Adelaide

- Zero Waste initiative, SA

- Reducing energy use and greenhouse gas emissions - roadworks applications

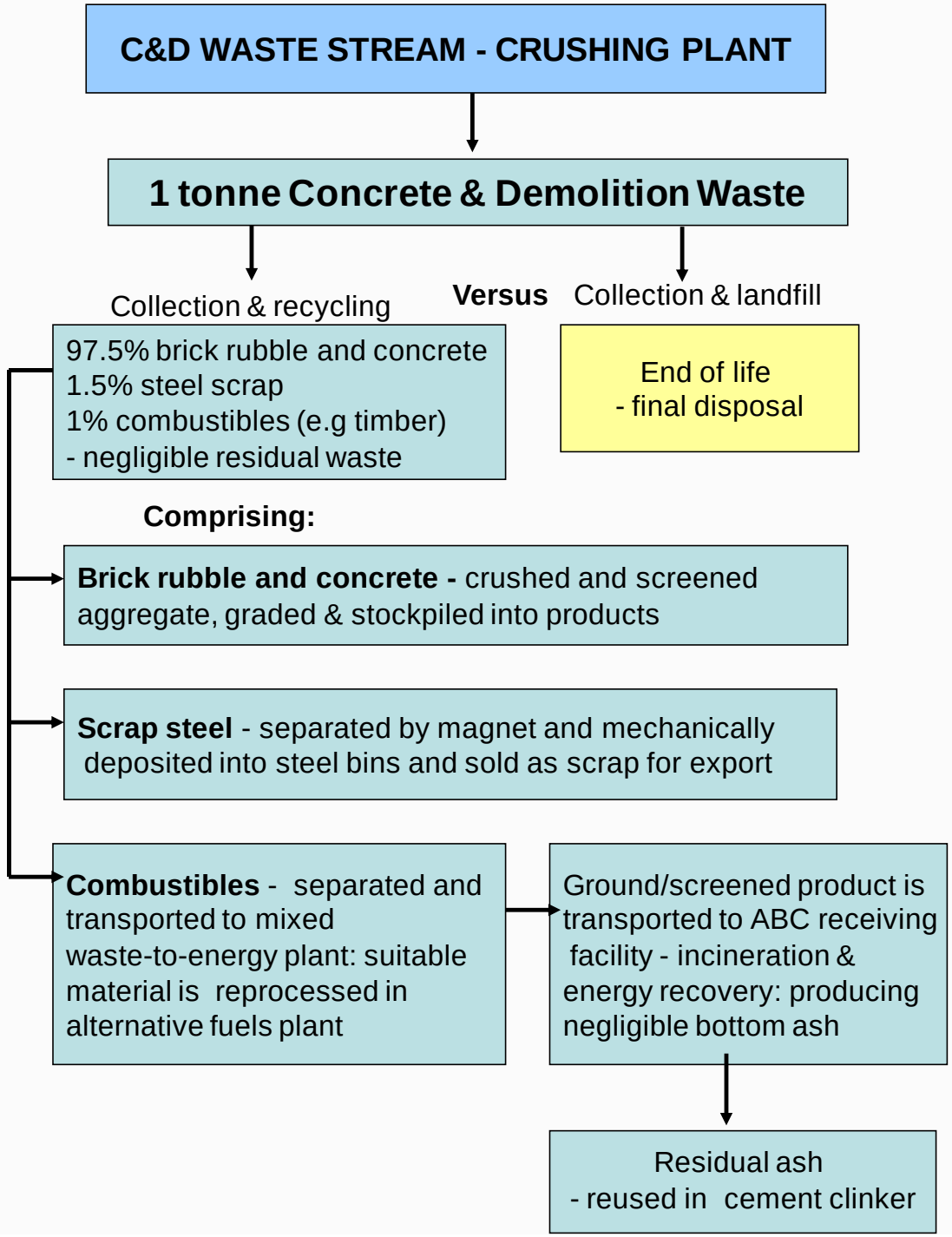
- Conclusions

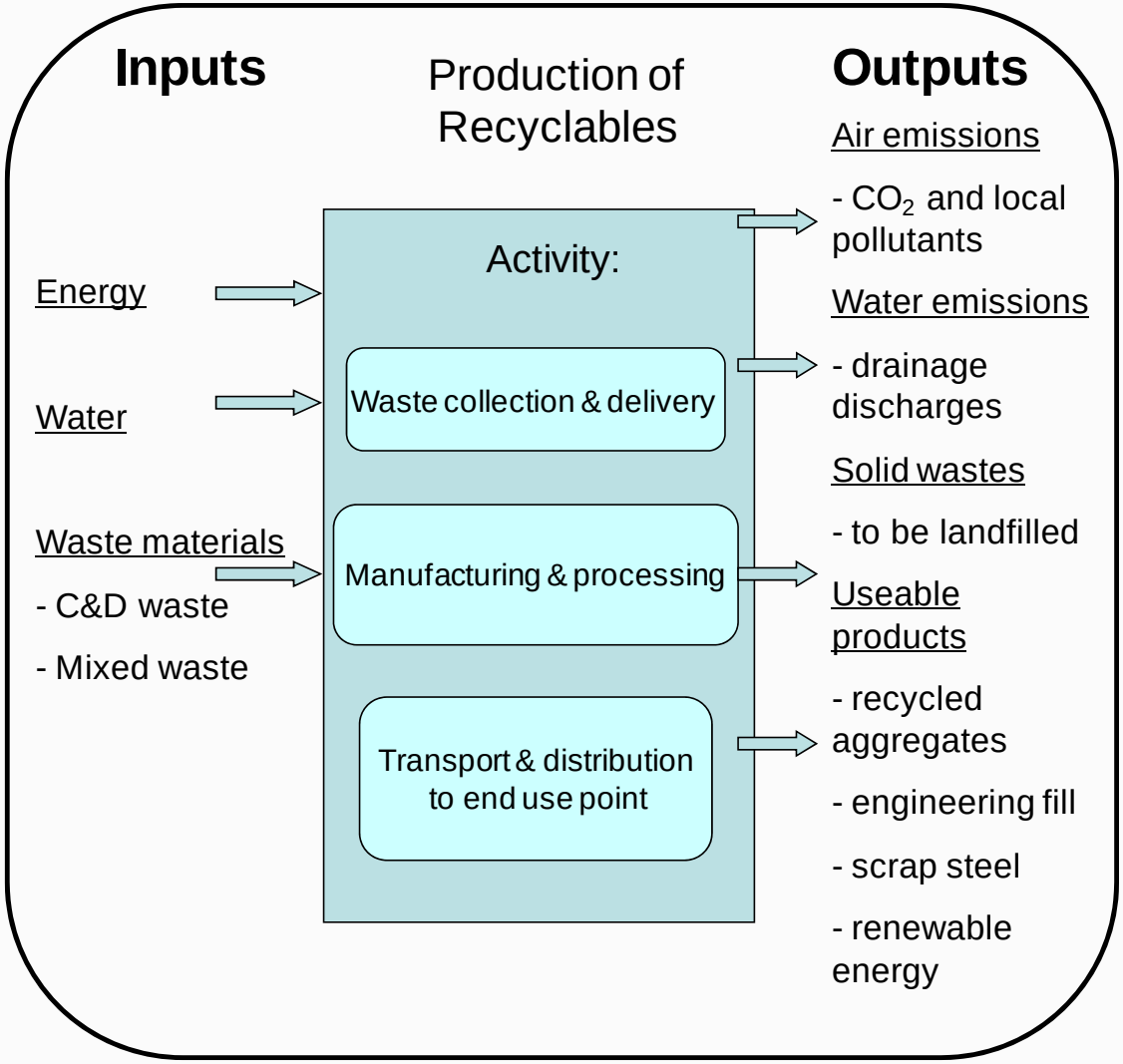
Resourceco (SA) case study

Study aimed to develop a method and collect data on:

- Energy use, greenhouse gas emissions and other enviro/social impacts of recycling operations
- Beneficial reuse options for recycled materials

- Crushing plant at Resourceco – 50,000 tonnes road base per month (90,000 last month)


C&D WASTE STREAM - CRUSHING PLANT
1 tonne Concrete & Demolition Waste
Collection & recycling
Versus
Collection & landfill
97.5% brick rubble and concrete
1.5% steel scrap
1% combustibles (e.g timber)
- negligible residual waste
End of life
- final disposal
Comprising:
Brick rubble and concrete - crushed and screened aggregate, graded & stockpiled into products
Scrap steel - separated by magnet and mechanically deposited into steel bins and sold as scrap for export
Combustibles - separated and transported to mixed waste-to-energy plant: suitable material is reprocessed in alternative fuels plant
Ground/screened product is transported to ABC receiving facility - incineration & energy recovery: producing negligible bottom ash
Residual ash
- reused in cement clinker

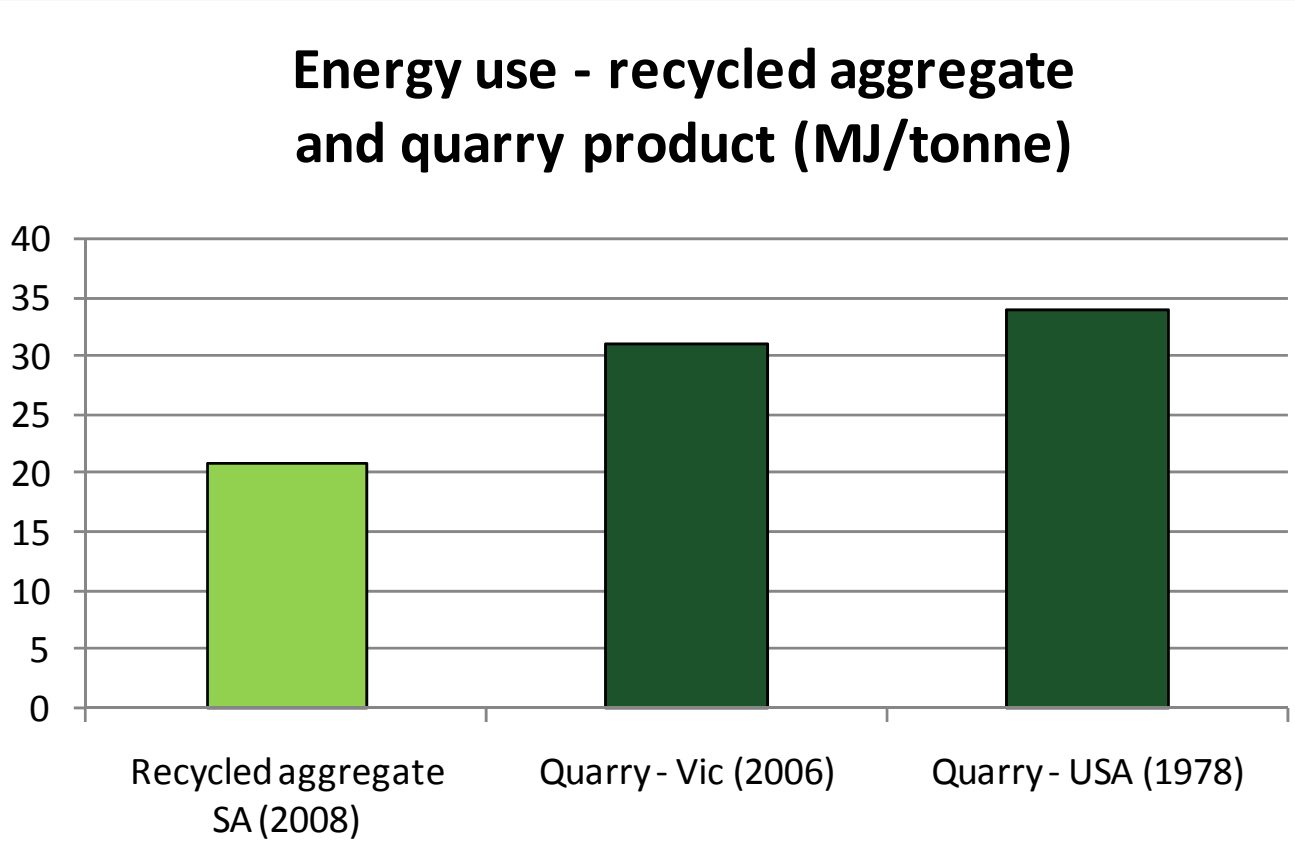


Overall impact assessment:

Recycling C&D and mixed waste versus landfill :

- greenhouse emissions, toxicity, pollution (air, water), biodiversity, social (noise, dust, aesthetics, severance, odours)

Comparison: overall energy usage



Energy use comparison: quarrying & reprocessing activities

Quarry product

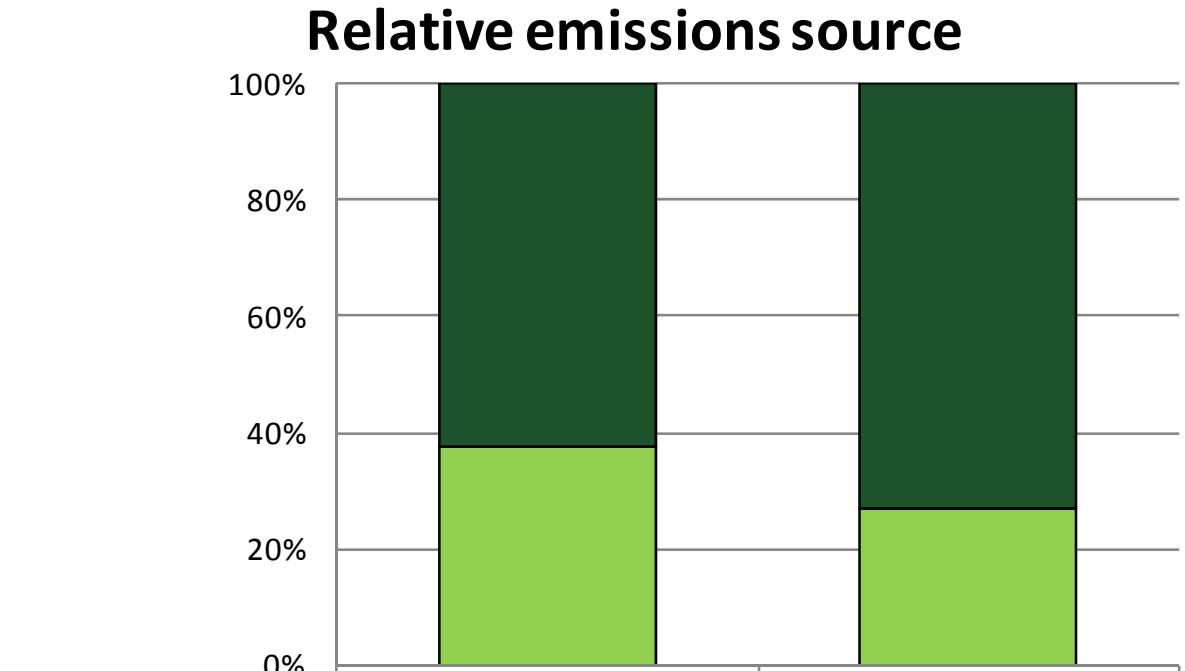
- removal of soil & overburden, extraction of hardrock by drilling & blasting (0.2%, 10 MJ/t or 30%)
- loading & hauling (2%, 14 MJ/t or 40%)
- crushing & screening (83%, 10%)
- Batching (15%, N/A)

Victorian study: USA study

Recycled product

- collection
- crushing & screening
- batching

Comparison: diesel & electricity usage



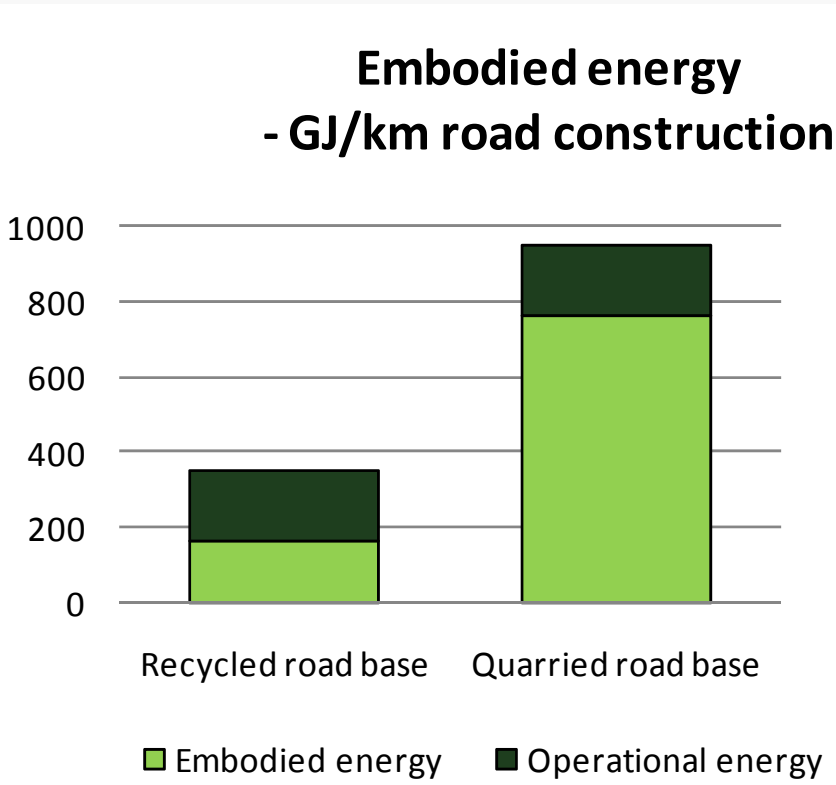
Comparison: $CO_{2\text{-}e}$ emissions

Total $CO_{2\text{-}e}$ per unit of production (preliminary)

- SA Resourceco study – 3 kg $CO_{2\text{-}e}$/tonne (21 MJ/t)
- Victorian quarry study – 7.5 kg $CO_{2\text{-}e}$/tonne (31 MJ/t)

- Embodied energy of recycled aggregates is approx. 30% less and emissions are approx. 60% less than quarried product (150 t/month)

Roadworks application – use of recycled aggregates



Relative CO_2-e emissions:

- Recycled road base (100%) = 24 t/km

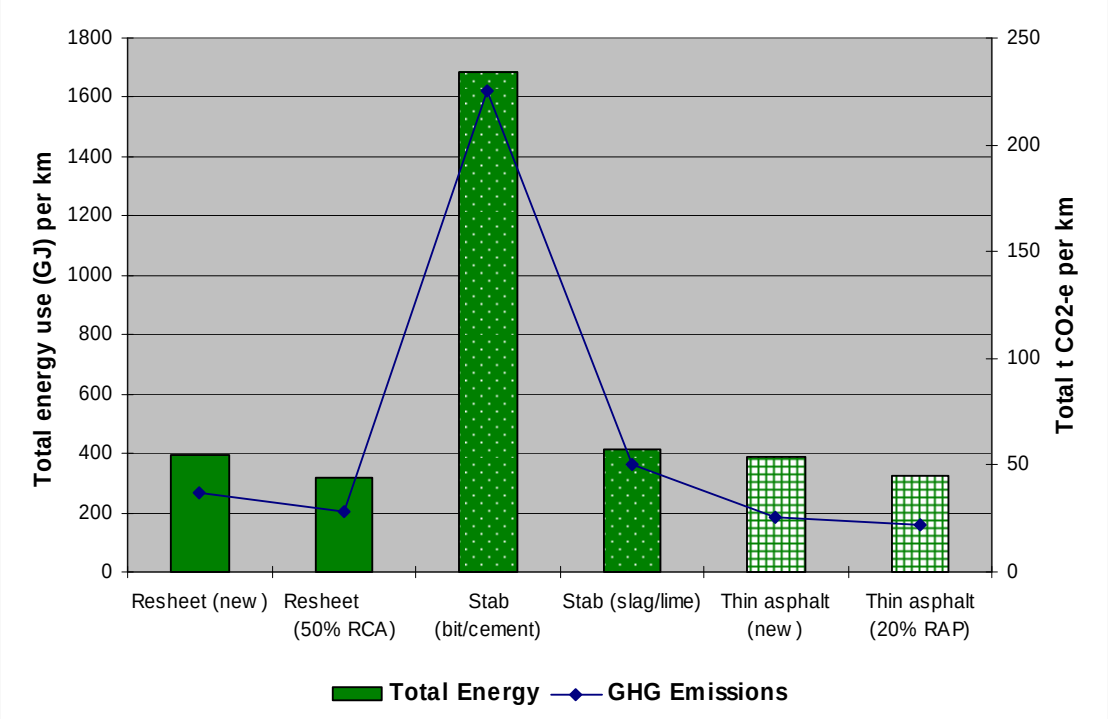
- Quarried road base (100%) = 72 t/km

Environmental gains – recycled aggregates

- Reduced resource consumption
- Diversion of waste materials from landfill
- Lower embodies energies & emissions (prelim)
- Reduced transport emissions where reused in close proximity to reprocessing

- Transport example: 1 t/km travelled – 10,000 t materials in a 1 km road construction

Roadworks application – cement substitutes & recycled aggregates



ARRB study for RTA (2005):

- Aim – reduce emissions in road const/maint

Maintenance treatments:

- Recycled aggregates replacement in resheeting: RAP & RCA
- Cement substitutes in stabilisation: slag & fly ash (70% lower emissions, assumes 20 km round trip for materials transport)

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Conclusions

This study has begun to collect some of the required data and develop a suitable framework.

There is a need for local studies investigating local applications:

- Quarrying and aggregates recycling – energy assessments to generate some indicative benchmark figures

“Carbon neutral” road construction

- In choosing a carbon neutral path, there is a recognised Carbon neutral hierarchy:

- **Reduce**: most cost effective but requires practice change
- **Renew**: purchase of renewable energy
- **Offset**: usually cheapest but value is questionable

There are limits to the carbon neutral claim