Brightway code of the implemented fuction to create a copy of an activity, identified with activity.id, and will modify the copied activity by substituting the technosphere processes with the preferable location indicated by the parameter locations.

```
def new_act_diff_location(database, activity_id, locations, new_name, project_name=Project_name):
    ''' This function will create a copy of an activity, identified with activity.id, and will modify the
copied activity by
    substituting the technosphere processes with the preferable location indicated by the parameter
locations.
    '''
    # is the modified process already in the database?
    if (len([act for act in database if act['name']==new_name])==0):
        # find activity to modify
        act_origin = [act for act in database if act.id==activity_id][0]
        act_new = act_origin.copy()
        act_new['name'] = new_name
        act_new['location'] = project_name
        act_new.save()

        for exc in act_new.technosphere():
            exc.delete()
            exc.save()
            act_new.save()

        # If GLO or RoW were not considered, add it at the end
        if 'RoW' not in locations:
            locations.append('RoW')
        if 'GLO' not in locations:
            locations.append('GLO')

        locations.reverse()

        for exc in act_origin.technosphere():
            for loc in locations:
            # Search for an exact match of the reference product with specified location
                for activity in database:
                    if activity['reference product'] == exc['name'] and loc in
                          activity['location'] and activity['name'] == exc.input['name']:
                        new_edge = activity


            act_new.new_edge(
                            input=new_edge.key,
                            name=new_edge['name'],
                            amount=exc.amount,
                            type="technosphere",
                        ).save()
            new_edge.save()

        return act_new

    print('The modified activity is already present in the database!!')
    return [act for act in database if act['name']==new_name][0]
```

Table S1: LCI of the traditional concrete.

Traditional concrete ingredient	Unit	Amount	Activity
cement, Portland	kilogram	316	cement production, Portland, GB
gravel	ton	0.28072	marine gravel extraction and transport, GB
gravel	ton	0.99528	land gravel extraction and transport, GB
sand	ton	0.15488	marine sand extraction and transport, GB
sand	ton	0.54912	land sand extraction and transport, GB
tap water	kilogram	142	market for tap water, Europe without Switzerland

Table S2: LCI of marine sand and gravel extraction (Kemp, 2008).

Stage	Flow	Unit	Amount	Activity
Dredging	Sand/Gravel	kg	1000	Sand/Gravel, unspecified, natural resources, in ground
	Diesel	MJ	18	diesel, burned in fishing vessel, GLO
Unloading	Diesel	MJ	7.1	diesel, burned in building machine, GLO
Processing	Electricity	kWh	1.51	market for electricity, medium voltage, GB
	Water	kilogram	350	market for tap water, Europe without Switzerland
Transport		ton*kilometer	250	transport, freight, inland waterways, barge, RER
Output	Sand/Gravel	ton	1	

Table S3: LCI of land sand and gravel extraction (Kemp, 2008).

Stage	Flow	Unit	Amount	Activity
Crushing rocks	Sand/Gravel	kg	1000	Sand/Gravel, unspecified, natural resources, in ground
	Diesel	MJ	27.74	diesel, burned in building machine, GLO
Processing	Electricity	kWh	3.05	market for electricity, medium voltage, GB
	Water	kilogram	350	market for tap water, Europe without Switzerland
Transport		ton*kilometer	400	market group for transport, freight train, RER
Output	Sand/Gravel	ton	1	

Table S4: Characterization factors of the biosphere flows according to the impact assessment method EF 3.1 EN15804, considered to compute the water use impact.

Biosphere flow	Categories	CF
Water	('air', 'lower stratosphere + upper troposphere')	-3.5
Water	('water', 'ground-')	-3.5
Water	('water', 'surface water')	-3.5
Water	('water', 'ocean')	0
Water	('air', 'non-urban air or from high stacks')	-3.5
Water	('air',)	-3.5
Water	('air', 'urban air close to ground')	-3.5
Water	('air', 'low population density, long-term')	-3.5
Water	('water',)	-3.5
Water, cooling, unspecified natural origin	('natural resource', 'in water')	3.5
Water, in air	('natural resource', 'in air')	3.5
Water, lake	('natural resource', 'in water')	3.5
Water, river	('natural resource', 'in water')	3.5
Water, salt, ocean	('natural resource', 'in water')	0
Water, salt, sole	('natural resource', 'in water')	3.5
Water, turbine use, unspecified natural origin	('natural resource', 'in water')	3.5
Water, unspecified natural origin	('natural resource', 'in ground')	3.5
Water, unspecified natural origin	('natural resource', 'in water')	3.5
Water, unspecified natural origin	('natural resource', 'fossil well')	3.5
Water, well, in ground	('natural resource', 'in water')	3.5

Impact category	Impact unit	Cement	Coarse aggregates	Fine aggregates	Water
acidification	mol H+-Eq	6,37E-01	2,15E-01	1,19E-01	2,39E-04
climate change	kg CO2-Eq	2,94E+02	2,64E+01	1,46E+01	4,46E-02
climate change: biogenic	kg CO2-Eq	4,57E+00	1,56E-01	8,63E-02	8,97E-04
climate change: fossil	kg CO2-Eq	2,89E+02	2,62E+01	1,45E+01	4,36E-02
climate change: land use and land use change	kg CO2-Eq	4,88E-02	3,46E-02	1,91E-02	7,61E-05
ecotoxicity: freshwater	CTUe	4,28E+02	1,49E+02	8,22E+01	1,73E-01
energy resources: non-renewable	MJ, net calorific value	1,34E+03	3,87E+02	2,14E+02	7,95E-01
eutrophication: freshwater	kg P-Eq	2,82E-02	6,84E-03	3,78E-03	2,89E-05
eutrophication: marine	kg N-Eq	1,94E-01	8,39E-02	4,63E-02	4,69E-05
eutrophication: terrestrial	mol N-Eq	2,18E+00	9,00E-01	4,97E-01	4,47E-04
human toxicity: carcinogenic	CTUh	7,07E-08	2,45E-08	1,35E-08	1,97E-10
human toxicity: non-carcinogenic	CTUh	1,92E-06	2,11E-07	1,17E-07	2,56E-09
ionising radiation: human health	kBq U235-Eq	1,05E+01	4,21E+00	2,32E+00	1,66E-02
land use	dimensionless	3,17E+02	2,13E+02	1,17E+02	1,71E-01
material resources: metals/minerals	kg Sb-Eq	8,94E-04	6,34E-05	3,50E-05	2,41E-07
ozone depletion	kg CFC-11-Eq	1,53E-06	4,84E-07	2,67E-07	1,23E-09
particulate matter formation	disease incidence	4,96E-06	2,49E-06	1,37E-06	2,48E-09
photochemical oxidant formation: human health	kg NMVOC-Eq	6,37E-01	2,64E-01	1,46E-01	1,63E-04
water use	m3 world eq. deprived	2,58E-01	1,62E+00	8,92E-01	4,87E-01

Table S5: LCA results of the traditional concrete's ingredients.

Table S6: LCA results for climate change impact category for the concrete samples.

Concrete sample	Unit	Climate change impact
Traditional Concrete	kg CO2-Eq	334.95
Rice Husk Ash	kg CO2-Eq	319.29 (±6.45)
Wood Ash	kg CO2-Eq	284.44 (±38.72)
Wheat straw	kg CO2-Eq	213.46 (±12)
Corn cob	kg CO2-Eq	212.68 (±12.08)