Entity Description for Hamilton Street Railway Database

1. PERSON: a strong entity with (person\_id, first\_name, last\_name, gender, date\_of\_birth, street\_address, city, province, postal\_code and occupation) as attributes, person\_id as the primary key, a one-to-many relationship with CONTACT\_NUMBER (1,N), one-to-one relationships with PASSENGER (0,1), Bus\_driver (0,1) and Maintenance\_personnel (0,1) .
2. PASSENGER: a weak entity dependent on PERSON, that has (passenger\_id and passenger\_type) as attributes, passenger\_id as the primary key, both attributes as foreign keys (passenger\_id references person\_id in PERSON while passenger\_type references passenger\_type in FARE) and one-to-one relationship with both PERSON (0,1) and FARE (1,1).
3. BUS\_DRIVER: a weak entity dependent on PERSON, that has (driver\_id, salary and years\_of\_service) as attributes, driver\_id as both the primary key and a foreign key (driver\_id references person\_id in PERSON) and a (0,1) one-to-one relationship with PERSON.
4. MAINTENANCE\_PERSONNEL: weak entity dependent on PERSON that has (maintenance\_personel\_id, salary, years\_of\_service, job\_level, and area\_of\_specilaization) as attributes, maintenance\_personnel\_id as both the primary key and a foreign key (maintenance\_personnel\_id references person\_id in PERSON), a (0,1) one-to-one relationship with PASSENGER and one-to-many relationship with BUS\_MAINTENANCE\_PERSONNEL\_MAPPING (1,N).
5. CONTACT\_NUMBER: a weak entity dependent on PERSON which has (1,N) many-to-one relationship with PERSON, has (contact\_id, person\_id, phone\_number, phone\_number\_type), contact\_id and person\_id as primary keys and person\_id as a foreign key that references person\_id in PERSON.
6. DRIVING\_INFRACTION: weak entity dependent on BUS\_DRIVER in a (0,N) many-to-one relationship, has a composite primary key (driver\_id, infraction\_date), driver\_id as a foreign key (references driver\_id in BUS\_DRIVER) and other attributes (infraction\_type, demerit\_points, and financial\_penalty)
7. BUS: strong entity with (bus\_id – primary key, years\_in\_operation, manufacturer, number\_of\_seats, type\_of\_fuel, adverstising\_revenue, route\_id -foreign key) as attributes, has one-to-many relationship with both BUS\_MAINTENANCE (0,N) and BUS\_DRIVER\_Log (0,N) , (1,N) many-to-one relationship with ROUTE, and one-to-many relationship with SCHEDULE (1,N).
8. EVENT: strong entity in one-to-many relationship with SITE\_EVENT\_MAPPING (0,N) entity, and has (event\_id – primary key, event\_date, event\_time, event\_participants, event\_name) as attributes
9. ROUTE: strong entity in one-to-many relationship with BUS (1,N), CONTAIN (1,N), and BUS\_DRIVER\_LOG(0,N), and has (route\_id – primary key and route\_name) as attributes.
10. STOP: strong entity that has one-to-many relationship with SITE\_BUS\_STOP\_MAPPING (0,N) and CONTAIN (1,N) entity; and has (stop\_id – primary key and stop\_name) as attributes
11. FARE: strong entity that has one-to-one relationship with PASSENGER; and has (passenger\_type – primary key and fare\_amount) as attributes
12. SITE: strong entity that has one-to-many relationship with SITE\_BUS\_STOP\_MAPPING (1,N) and SITE\_EVENT\_MAPPING (0,N), and has (site\_id – primary key, site\_name, address, phone\_number, capacity, category) as attributes
13. BUS\_MAINTENANCE: weak entity dependent on BUS, has a (0,N) many-to-one relationship with BUS and one-to-many (0,N) relationship with BUS\_MAINTENANCE\_PERSONNEL\_MAPPING; and has (maintenance\_id – primary key, bus\_id (FK), fix-date) as attributes
14. BUS\_MAINTENANCE\_PERSONNEL\_MAPPING is an associative entity that associates MAINTENANCE\_PERSONNEL and BUS\_MAINTENANCE, has (maintenance\_id and maintenance\_personnel\_id) as both primary and foreign keys; and has many-to-one relationship with both MAINTENANCE\_PERSONNEL (1,N) and BUS\_MAINTENANCE (0,N).
15. SITE\_EVENT\_MAPPING is an associative entity associating EVENT and SITE; has (site\_id, event\_id) as both primary and foreign keys; has many-to-one relationship with both EVENT (0,N) and SITE (0,N).
16. SITE\_BUS\_STOP\_MAPPING is an associative entity associating STOP and SITE; has (site\_id, stop\_id) as both primary and foreign keys; and has many-to-one relationship with both STOP (0,N) and SITE (1,N).
17. SCHEDULE is an associative entity that associates BUS and CONTAIN with attributes (schedule\_id – primary key, contain\_id – foreign key, arrival\_time, arrival\_date, bus\_id – foreign key); and has many-to-one relationship with both BUS (0,N) and CONTAIN (0,N)
18. CONTAIN is an associative entity that associates ROUTE with STOP with (stop\_id – foreign key, route\_id – foreign key, contain\_id – primary key) attributes; and has many-to-one relationship with STOP (1,N) and ROUTE (1,N) and one-to-many relationship with SCHEDULE (0,N)
19. BUS\_DRIVER\_LOG is an associative entity that associates BUS\_DRIVER, ROUTE and BUS with attributes (log\_id – primary key, bus\_id – foreign key, driver\_id – foreign key, route\_id – foreign key, start\_time, end\_time); and has many-to-one relationship with all three (0,N).

NB:

* The relationship “Each site is served by at least one route, and a route can serve zero or more sites” exists implicitly in the ERD. It can be achieved by a multi-join (i.e.: join SITE to SITE\_BUS\_STOP\_MAPPING to STOP to CONTAIN).
* The statement “The arrival times record bus arrivals from 6am to 11pm each day between May 1 and May 7, 2023” was implemented in the attached *HSR.ddl* script.